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ABSTRACT

Annotations and bibliographic information are provided for reports, journal articles and other documents referring to scientists and engineers received by the U. S. Civil Service Commission library between 1965 and 1969. The documents are classified and reported in the following sections: supply and demand for technical personnel; personnel management in the federal government (with subsections on major studies and reports; recruitment, selection and training; and salary administration); managing scientists and engineers in private industry (subheadings are bibliography; general aspects; recruitment and selection; training and development; and pay practices); evaluating performance; selecting and developing technical personnel for management responsibilities; personality and professional characteristics; identifying and developing scientific creativity; and organizational, motivational and supervisory factors affecting performance (subsections for federal government research organizations and industrial organizations). (AL)

Scientists and Engineers in the Federal Government

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FOREWORD

This compilation updates Personnel Bibliography no. 15 issued in 1965 and thus covers material received from 1965-1969. Since other numbers in the Personnel Bibliography Series cover general aspects of personnel administration such as recruitment, training, etc., only references relating specifically to scientists and engineers are included here. This bibliography was reviewed by Mr. Frank Witham, Bureau of Policies and Standards.

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SCIENTISTS AND ENGINEERS IN THE FEDERAL GOVERNMENT

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SUPPLY AND DEMAND FOR TECHNICAL PERSONNEL

Adams, Walter, ed.
The brain drain. New York, The Macmillan Co., 1968. 273 pp.
A collection of papers on all aspects of "the brain drain," i. e., the history, the causes, the pros and cons, the cures, and case studies of France, Greece, the European Common Market, Africa, India, and the underdeveloped countries. Those involved are primarily scientists, engineers and professional employees.

Alden, John D.
The engineering placement squeeze. Journal of college placement, vol. 28, no. 2, December 1967-January 1968, pp. 58-61, 134, 136, 138.
Points out the confusion resulting from the lack of clear nomenclature used to define engineering degrees and specialties. Remarks that what the recruiter often seems to want is a person who can solve technological problems and he uses the term "engineer" to identify that type of individual. Regardless of terms, engineer shortages exist and trends in earnings are rising.

American Society for Engineering Education.
The engineering technician. Washington, 1968. 20 pp.
Examines qualifications and training needed for a career as an engineering technician and provides information on various fields of specialization.

Andrews, Edith W. and Maurice Moylan.
Scientific and professional employment by state governments. Monthly labor review, vol. 92, no. 8, August 1969, pp. 40-45.
Represents a study from 1959 to 1967 of trends in the employment of scientists, technical, and selected professional personnel by state governments. Results show that, despite the creation of new kinds of jobs, these fields continue to run low on state employment scales--in 1967 only three percent of the total of all sectors, and those in three highly concentrated areas: highways and public works; health and welfare, or agriculture and conservation.

Bolt, Richard N.
1970--what positions will be up front in demand and challenge. Journal of college placement, vol. 26, no. 3, February-March 1966, pp. 59-60+.
Analyzes how national goals will affect employment market for college-trained manpower, especially scientists and engineers.

Bowen, Charles R.
The critical need for trained technicians. Technical education news, vol. 27, no. 4, June 1968, pp. 1-3.
Projected figures indicate a serious hiatus in the next ten years between the supply of trained technicians and the actual need for them, particularly those assisting scientists and engineers. Suggestions are made for raising the prestige of technical schools and for alerting industry to plan ahead for its manpower needs.

Bumas, Lester O.
The economics of engineering and scientific manpower: a comment. Journal of human resources, vol. 3, no. 2, Spring 1968, pp. 246-252.
Comment about article by W. L. Hansen, "The economics of scientific and engineering manpower," from The Journal of human resources, vol. 2, no. 2, Spring, 1967. (See page 37 of this bibliography)

Career opportunities; unfilled needs in a society in ferment. Chemical and engineering news, vol. 45, no. 11, March 13, 1967, entire issue.
Annual career guide. One section covers overall manpower needs, salary levels, and other general information; the other is concerned with how needs and trends in major sectors of society will affect the demand for chemists and chemical engineers.

Engineering degrees 1966-67. Journal of engineering education, vol. 59, February 1969, pp. 515-527.
Report based on prepublication data furnished by the National Center for Educational Statistics of the U. S. Office of Education. It fills the gap between published data for 1956-66 and for 1967-68. Data on degree level, sex of recipient, state and institution.

Engineering Manpower Commission.
Demand for engineers and technicians--1966. New York, 1966. 96 pp.
Survey based on questionnaires returned from 490 organizations. It covers demand for engineers and technicians, enrollments, hires and separations, and projected growth of employment in industry and in education in Federal and state and local government.

Engineering Manpower Commission.
Engineering and technician enrollments, Fall 1968.
New York, Engineers Joint Council, 1969. 222 pp.

Engineering Manpower Commission.
Engineering degrees 1967-68. New York, 1968. 56 pp.
Gives statistics on enrollment by curriculum and degree level for U. S. engineering schools. Also covered is information on bachelor of technology degrees and the numbers of foreign students at each degree level in each institution.

Engineering Manpower Commission.
Foreign-born and educated engineering manpower in the U. S. A report ... New York, Engineers Joint Council, 1969. 15 pp.
Survey was concerned with (1) Engineer immigrants vs. U. S. engineer manpower output; (2) Countries of origin of engineer immigrants; (3) Occupational categories of engineer immigrants and (4) Immigrant engineers as related to projection of future needs.

Supply and Demand for Technical Personnel (Cont'd)

Engineering Manpower Commission.
Prospects of engineering and technology graduates, 1968. New York, Engineers Joint Council, 1968. 43 pp.
Annual survey of June graduating classes to evaluate trends in placement and occupations. Includes data on technology graduates, starting salaries, enrollments and degrees.

Engineering Manpower Commission.
Trends in engineering technician enrollments and graduates. New York, 1967. 67 pp.
Includes charts: "Annual Salary as a Function of Years Since Graduation, 1966" and "Projected Growth of Technician Employment, 1965-1976."

Engineers Joint Council.
Proceedings, Summer employment for engineering students conference. Sponsored by National Academy of Engineering and...Engineers' Council for Professional Development. New York, 1965. 84 pp.

Engineers Joint Council.
Summer employment of engineering students; final report. New York, 1965. 1 v.
Findings of a survey of colleges, employers, and students on such issues as the value of summer technical work as a part of an engineering education, the advantages of the employment, the benefits to employers, and the number of jobs needed.

Fisher, Robert W.
Professionals on the move. Monthly labor review, vol. 91, no. 11, November 1968, pp. 32-34.
Discusses pluses and minuses of sharp increase in immigration of scientists, engineers and physicians from underdeveloped countries to U. S. due to recent changes in the Immigration and Nationality Act.

Foecke, Harold A.
The engineering manpower situation present and future; an analysis. New York, Engineers Joint Council, Engineering Manpower Commission, 1965. 12 pp.
Author concludes that in the long run the engineering supply and demand picture is a favorable one.

The future supply of engineers.
Engineering manpower bulletin, no. 6, April 1967, pp. 1-6.
Statistics and trends illustrating how the supply of new graduate engineers will probably develop over the next few years.

Great Britain. Committee on Manpower Resources for Science and Technology.
The brain drain; report... the Working Group on Migration. London, H. M. Stat. Off., 1967. 124 pp. (Cmnd. 3417)
Report concentrates on the causes and effects of the immigration to North America, particularly to the United States, of engineers, technologists and scientists. Chapters on motivations, educational and research aspects of migration, salaries and taxation, recruiting in North America, and remedies and non-remedies.

Supply and Demand for Technical Personnel (Cont'd)

Great Britain. Committee on Manpower Resources for Science and Technology. The flow into employment of scientists, engineers and technologists. Report of the Working Group on Manpower for Scientific Growth. London, H. M. Stat. Off., 1968. 186 pp.

The report shows a number of serious imbalances in the present patterns of flow of qualified manpower compared with the needs of employment, and proposes short-term and longer-term reforms. Mobility between sectors of employment is covered in Chap. 10.

Great Britain. Committee on Manpower Resources for Science and Technology. A review of the scope and problems of scientific and technological manpower policy. London, H. M. Stat. Off., 1965. 17 pp.

Covers statistical sources, factors affecting the choice of a scientific or technological career, the educational system and the requirements of employers, and utilization of qualified manpower. Concludes with suggestions for immediate action and for the future.

Great Britain. Department of Education and Science. The employment of highly specialised graduates; a comparative study in the United Kingdom and the United States of America, by M. C. McCarthy. London, England, H. M. Stat. Off., 1968. 36 pp. (Science policy studies, no. 3)

Compares university curricula, career patterns and time spent in training to determine present supply and future requirements of scientific and engineering "specialists" and "generalists" in Great Britain and America.

Partial contents: Educational patterns in American and British universities; British and American employment patterns; Specialist employment categories; Technological obsolescence, and the anticipation of technological change; Means of overcoming technological obsolescence; The dialogue between university and industry.

Great Britain. Ministry of Technology. The survey of professional engineers, 1966. London, H. M. Stat. Off., 1967. 36 pp.

Survey of the age, education, qualifications, responsibilities, income, and fields of activity of British professional engineers.

Great Britain. Treasury. Report of a committee appointed to review the organisation of the Scientific Civil Service. London, H. M. Stat. Off., 1965. 28 pp.

Covers the historical and factual background of the Scientific Civil Service, its functions and requirements, and the case for merging or reorganizing the various scientific classes. There are sections on such specifics as promotion, appointments, recruitment, links between the Scientific Civil Service and the universities and industry, grading and structure, higher posts, management training, career management, and the older scientist.

Supply and Demand for Technical Personnel (Cont'd)

Greenspan, Harry and Edith Andrews.
Engineers and scientists in private industry. Monthly labor review, vol. 91, no. 5, May 1968, pp. 41-46.
Cites BLS survey indicating employment of scientists, engineers and technicians in private industry increased at a significantly faster rate than did total employment, 1961-1966. This can be attributed largely to research and development demands of both Federal government and private industry. Compares growth rates for scientific professions and analyzes ratios between scientists, engineers and technicians.

Gross, Andrew C.
Engineering manpower in Canada. Engineering manpower bulletin, no. 13, March 1969. 6 pp.
Findings from the author's doctoral thesis on Candadian engineers, with selected comparisons with United States engineers. Focuses on supply, education, distribution, and earnings, using historical data. Also surveys mobility patterns and utilization of electrical engineers graduating in the years 1954, 1959, and 1964.

Grubel, Herbert G.
The brain drain. Wharton quarterly, vol. 1, no. 3, Spring-Summer 1967, pp. 32-37.
Comments on the nature and magnitude of this "complex phenomenon," cites selected statistics and shows effects on nonimmigrants. Concludes "most foreign commentators point to inhospitable intellectual, political, social, and institutional climates in native countries, rather than lower wages, as the main causes of the reluctance of students to return." (First published in Science, vol. 154, no. 3755, December 1966)

Hall, C. C.
Your future managers...a factor in location decisions. Manage, vol. 20, no. 10, September 1968, pp. 35-37.
Eighty per cent of the country's scientists and engineers are located in only 14 states. Industry is beginning to consider this in choosing plant sites.

Hansen, W. Lee.
The economics of scientific and engineering manpower. Journal of human resources, vol. 2, no. 2, Spring 1967, pp. 191-220.
Defines some of the issues in the discussion of shortages of engineering and scientific manpower, alternative approaches to research in the field, and analytical efforts of economists. Also reviews various approaches to the analysis of supply and demand in the field.

Howell, Richard P.
Engineers on the move. Engineering manpower bulletin, no. 11, 1968.
Examines findings of a Stanford Research Institute study on technical professionals who perform research and development in the aerospace-defense industry. Covers geographical, inter-institutional, and inter-specialty mobility.

Supply and Demand for Technical Personnel (Cont'd)

Jensen, Charles S.
Wanted: manpower for utopia. S.A.M. advanced management journal, vol. 34, no. 3, July 1969, pp. 13-20.
Although there has been an increased impact of technology on our lives, we have experienced a decreased ratio in the number of technicians needed to assist professional men. One major reason for this is a certain "snob" element in our educational system and in society in general. Seven suggestions are made as to how we could help build up technical and vocational education.

Kuhn, James W.
Scientific and managerial manpower in nuclear industry. New York, Columbia University Press, 1966. 209 pp.
Prepared under contract with the Office of Manpower Policy, Evaluation and Research, Department of Labor. Traces and makes preliminary analysis of "causal effects of manpower policies upon technological change." Comments on conflict between scientists and management, the role of the Federal government, the response of the universities and other related topics.

Lapp, Ralph E.
Where the brains are. Fortune, vol. 73, no. 3, March 1966, pp. 154-156, 178-179.
Examines geographic distribution of top level U. S. scientists, and comments on reasons for migration of the scientific population.

LeBold, William K.
Purdue engineering graduates of the late thirties. Journal of engineering education, vol. 58, no. 4, December 1967, pp. 283-286.
Profile drawn from questionnaires. Reports findings on education, employment, professional activities, income, salary. "Substantial increases in job satisfaction, responsibility level, and salary were noted between initial employment and employment 25-30 years later."

LeBold, William K., Robert Perrucci and Warren Howland.
The engineer in industry and government. Journal of engineering education, vol. 56, no. 7, March 1966, pp. 237-273.
Summary of survey of engineering graduates undertaken by the Goals of Engineering Education Project. It focused primarily on the engineering graduate but also obtained views of industrial and governmental organizations on their present and future needs for engineering talent. It presents a profile of the engineering graduate, his education, experience, employment, salary, professional activities, and views on continuing and graduate education. Attached is an almost exact replica of the original questionnaire.

Supply and Demand for Technical Personnel (Cont'd)

Ledbetter, Donald L.
Early vesting pensions and engineer mobility. American engineer, vol. 38, no. 6, June 1968, pp. 34-38.
Presents a brief for an engineer pension status equivalent to that enjoyed by self-employed persons or those in organizations with centralized plans. Emphasizes the need for vesting and portability benefits because of the unique mobility requirement of engineering.

Loomba, R. P.
A study of the re-employment and unemployment experiences of scientists and engineers laid off from 62 aerospace and electronics firms in the San Francisco Bay Area during 1963-65. San Jose, Calif., San Jose State College, Center for Interdisciplinary Studies, Manpower Research Group, 1967. 121 pp.
Partial contents: Personal characteristics of the respondents; The layoff experience; The unemployment experience; Job search activities; The post-layoff employment; Job history: January 1961 to November 1965; Occupational conversion: defense to commercial work.
Study concludes with recommendations to state and Federal agencies, defense-oriented companies, commercial companies, and to engineers and scientists themselves.

Loomba, R. P. and others.
Proceedings of the National Symposium on Stabilization of Engineering and Scientific Employment in Industry. San Jose, Calif., San Jose State College, Center for Interdisciplinary Studies, Manpower Research Group, 1966. 101 pp.
Partial contents: The stabilization of engineering employment by correction of the factors producing instability, by Paul W. Crappuchettes; The impact of defense cutbacks on scientists and engineers; problems and opportunities, by Geoffrey Faux; The possible contributions of collective bargaining toward stabilization of engineering and scientific employment in industry, by Robert Leventhal.

Marczoch, Sigrid.
Will your pension plan move with you? American engineer, vol. 37, no. 3, March 1967, pp. 24-28.
"An engineer's mobility is often severely restricted by his employee pension plan." Comments on a proposal before Congress (the Dingell Bill) which calls for a government-administered portability plan and on plans for setting up a portable pension system within the National Society of Professional Engineers.

Milani, Ernest J.
The new breed of gypsy technicians. Personnel, vol. 44, no. 6, November-December 1967, pp. 56-60.
An increasing number of engineers and technicians go from one short-term contract job to another with advantages both to themselves and to industry. Among the benefits to employees are higher pay, wider range of experience making it possible to keep abreast of new techniques and developments and a growing list of fringe benefits. An advantage to corporations hiring such personnel is elimination of recruitment costs for persons needed for limited periods of time.

Supply and Demand for Technical Personnel (Cont'd)

Mills, Thomas J.
Scientific personnel and the professions. Annals of the American Academy of Political and Social Science, vol. 367, September 1966, pp. 33-42.

Comments on some of the considerations which have engendered interest in the migration of scientists and engineers. Examines extent to which foreign nationals in these fields are currently emigrating to the United States and looks at some data which measure the extent to which our present stock of scientists and engineers is of foreign origin.

National Academy of Sciences--National Research Council.
Profiles of Ph.D's in the sciences; summary report on follow-up of doctorate cohorts, 1935-1960. Washington, 1965. 123 pp. (Publication 1293; career patterns report no. 1)

Data on employment and geographic migration of doctorate-holders, sources of support for education, social and job mobility and field changes, women doctorate-holders, and earnings of doctorate-holders. Prepared for the National Institutes of Health.

National Society of Professional Engineers.
Vesting and portability in pension plans; a panel discussion. n. p., 1967. 20 pp.

Panelists at the annual meeting held in Hartford, Connecticut, July 6, 1967 were: Frank Cummings, former minority labor counsel to the Senate Labor and Public Welfare Committee; Andrew Melgard, of the Human Resources Development Group, Chamber of Commerce of the United States; and Charles E. Tosch, formerly a consultant in employee benefits with the General Electric Company in New York and now vice president of Johnson and Higgins of Wall Street, New York.

National Society of Professional Engineers. Professional Engineers in Government.
The engineer in state government; a study of merit system coverage and personnel policies based on surveys conducted in 1960 and 1964. Washington, 1965. 22 pp. (Publication no. 1303)

Data on coverage of engineers by merit or civil service systems, registration requirements, occupational titles and grade levels, education and experience requirements, educational opportunities, and participation in technical and professional societies.

Organisation for Economic Co-operation and Development.
Training of and demand for high-level scientific and technical personnel in Canada. Paris, 1966. 136 pp. (Reviews of national policies for education)

Includes detailed statistics on scientists and engineers in Canada, with projections to 1971, as well as net exchanges of professionals between Canada and U. S. 1950-63.

Pan American Health Organization.
Migration of health personnel, scientists, and engineers from Latin America. Report prepared by the PAHO Subcommittee on Migration for the PAHO Advisory Committee on Medical Research. Washington, 1967. 118 pp.

Supply and Demand for Technical Personnel (Cont'd)

Papier, William.
"Push-pull" and "brain drain." Personnel administration, vol. 31, no. 6, November-December 1968, pp. 43-49.
Comments on mobility and push-pull factors which have resulted in extensive national reallocation of professional manpower (especially R and D personnel) both geographically and functionally. Advocates an investigation into the full nature and extent of the shifts and their effects on the nation's interests.

Parker, John E.
Interactions of external and internal labor markets for engineers and scientists. In Industrial Relations Research Association. Proceedings of the Eighteenth Annual Winter Meeting, New York, December 28 and 29, 1965, edited by Gerald G. Somers. Madison, Wisc., Industrial Relations Research Association, 1966, pp. 264-275.
A report on labor market interactions for scientists and engineers in the aerospace industry, with an exploration of some of the mobility patterns, and an examination of the organization's impact on these patterns. Taken from the complete study by Parker, The labor market behavior of engineers and scientists: an analysis in the aerospace industry. Doctoral dissertation, University of Wisconsin, 1963.

The right man for the job. Environmental science and technology, vol. 2, no. 8, August 1968, pp. 586-588.
Thousands of new jobs are being created as a result of the national environmental program. The need for improved personnel policies as well as training more technicians is stressed and efforts in these directions reviewed. Includes a list of environmental programs in two-year colleges.

Roe, Anne.
Changes in scientific activities with age. Science, vol. 150, no. 3694, October 15, 1965, pp. 313-318.
Report of a continuous study of eminent research scientists indicates that they change little--unless they go into administration. Honors, retirement, research support, administration, the nature of research, and publications are factors covered in the study which includes the lives of social scientists as well as of those in the biological and physical fields.

Rossi, Alice S.
Women in science: why so few? Science, vol. 148, no. 3674, May 28, 1965, pp. 1196-1202.
The quandary of American women today remains the choice between marriage and parenthood or a career, even though thinking has changed regarding their role since the 40's and 50's. Social and psychological influences from childhood onward have resulted in fewer women in the scientific field than in any other. To encourage women scientists we must: educate boys and girls for all their major adult roles (parents, workers, creatures of leisure); stop restricting and lowering occupational goals of girls; apply our technological skill to a rationalization of home maintenance; and encourage men to be more articulate about themselves as males and about women

Supply and Demand for Technical Personnel (Cont'd)

Schiller, Ronald.
Help wanted: engineers and scientists. Reader's digest, vol. 90, February 1967, pp. 193-194, 196-198.
Discusses the shortage and crying need for scientists and engineers resulting from the scientific and technological explosion.

Scientific and technical personnel in the Federal government, 1966.
Reviews of data on science resources, no. 14, April 1968. 22 pp. (NSF 68-16)
Provides data for professional and nonprofessional personnel on occupational groups, position series, distribution by agency, and pay. Also includes information on women professional employees.

Scientific Manpower Commission and the Engineering Manpower Commission of Engineers Joint Council.
Employer's inventory of critical manpower. New York, Engineers Joint Council, 1968. 28 pp.
" ... contains the forms and instructions through which employers can make a quick analysis of the probable liability of their male employees ... for military service under the Military Selective Service Act of 1967, and the Armed Forces Reserve Act of 1952, as amended ...."

Tavernier, Gerard.
The vanishing trainees. Personnel and training management (Great Britain), vol. 33, no. 328, November 1967, pp. 18-23.
Survey of 1144 technicians and technologists with company-sponsored education, reveals a high percentage leaving their sponsors within two years of graduation. Reasons given include under-utilization, better job offers, and lack of opportunity and poor prospects.

Torpey, William G.
Employer views toward engineering manpower aspects of defense cutbacks. Personnel journal, vol. 47, no. 11, November 1968, pp. 792-795.
"This article considers the impact of changing priorities upon the nation's pool of scientific and technical manpower, using as an example cutbacks in the defense program." Suggestions for dealing with resulting manpower problems are offered for employers, for government, for engineers, and for professional and technical societies.

Torpey, William G.
The impact of defense cutbacks on engineering manpower. Journal of engineering education, vol. 58, no. 3, November 1967, pp. 227-229.
Figures indicate that 18% of all engineers are in defense employment, more than half in aircraft and electrical specialties. Selected findings and recommendations from 23 research projects dealing with the impact of defense cutbacks are detailed and measures which could be adopted now to strengthen the engineering employment adjustment process are suggested.

Supply and Demand for Technical Personnel (Cont'd)

U. S. Bureau of Labor Statistics.
Employment characteristics of atomic energy work, 1967. Washington, 1967? 9 pp. (BLS report no. 333) Ie172 .Un17e

Provides statistics on categories of scientists, engineers, and technicians in the atomic energy field as well as a breakdown by segment or type of facility in which employed.

U. S. Bureau of Labor Statistics.
Occupational employment statistics 1960-66. Prepared by Arthur J. Gartaganis. Washington, U. S. Govt. Print. Off., 1968. 32 pp. (Bulletin no. 1579)

Data for engineers, scientists, and technicians including statistics on employment in Federal, state and local governments.

U. S. Bureau of Labor Statistics.
Review of occupational employment statistics. Employment of scientific, professional, and technical personnel in state governments, January 1964. Washington, U. S. Govt. Print. Off., 1967. 29 pp. (Bulletin no. 1557)

Tabulates occupational data by position, type of agency, occupation, and state. Includes social workers and selected health-related professions.

U. S. Bureau of Labor Statistics.
Scientific and technical personnel in industry 1961-1966. Washington, U. S. Govt. Print. Off., 1968. 87 pp. (Bulletin no. 1609)

Gives estimates of the number and distribution of both part-time and full-time scientists, engineers and technicians employed in industry. Of interest are the sections on factors affecting employment and on the growth of functions. Statistics are given on scientists in industry working on Federal government contracts, on the geographic distribution of scientists and engineers, etc.

U. S. Bureau of Labor Statistics.
Technician manpower: requirements, resources, and training needs. Washington, U. S. Govt. Print. Off., 1966. 111 pp. (Bulletin no. 1512)

A major study of engineering and science technician manpower requirements and resources in 1975. Covers nature of work, employment and personal characteristics of technicians, training, and requirements for technicians, 1963-1975. Bibliography.

Article on data, "A million and a half technicians needed by 1975," appears in Occupational outlook quarterly, vol. 11, no. 1, February 1967, pp. 24-27.

Supply and Demand for Technical Personnel (Cont'd)

U. S. Congress. House. Committee on Government Operations.
The brain drain into the United States of scientists, engineers, and physicians. Washington, U. S. Govt. Print. Off., 1967. 110 pp. (H. Com. print, 90th Cong.)

Issues covered include: the significant composition of the brain drain, the share of the developing countries in it, and the relationship between this share and Federal research and development. Contains many tables.

U. S. Congress. House. Committee on Government Operations.
Scientific brain drain from the developing countries. Twenty-third report... Washington, U. S. Govt. Print. Off., 1968. 18 pp. (H. rept. no. 1215, 90th Cong.)

U. S. Employment Service.
The job market for engineers, scientists, technicians. Washington, U. S. Govt. Print. Off., 1968. 30 pp.
Semi-annual report covers employment trends in early 1968. Tables.

U. S. National Institutes of Health.
Trends in graduate enrollment and Ph.D. output in scientific fields, 1960-61 through 1965-66. Washington, U. S. Govt. Print. Off., 1968. 132 pp. (Resources for medical research, rept. no. 14)

U. S. National Science Foundation.
American science manpower, 1966; a report of the National Register of Scientific and Technical Personnel. Washington, U. S. Govt. Print. Off., 1968. 221 pp. (NSF 68-7)

Provides statistical data on education, specialization by field and work activity, type of employer, salary, age, sex, geographic location and language knowledge. Based on data obtained from scientists in the 1966 National Register of Scientific and Technical Personnel.

U.S. National Science Foundation.
Baccalaureate sources of science and engineering manpower. Reviews of data on science resources, no. 15, December 1968. 4 pp.

Reports findings of a study which compared the relative effectiveness in baccaulaureate production of various types of degree-granting institutions.

U. S. National Science Foundation.
Employment of scientists and engineers in the United States, 1950-66. Washington, U. S. Govt. Print. Off., 1968. 55 pp. (NSF 68-30)

Gives annual estimates of employed natural scientists and engineers for the years 1950-1966. Statistical data was prepared by the Bureau of Labor Statistics and then related to major economic and social developments as identified by the National Science Foundation.

Supply and Demand for Technical Personnel (Cont'd)

U. S. National Science Foundation.
Federal funds for research, development, and other scientific activities, fiscal years 1967, 1968, and 1969. Washington, U. S. Govt. Print. Off., 1968. 259 pp. (NSF 68-27)

Covers "Federal R & D support to every kind of performer, by character of work, by field of science, and by agency. Obligations are also reported for scientific and technical information activities and for the collection of general-purpose scientific data."

U. S. National Science Foundation.
Geographic distribution of Federal funds for research and development, fiscal year 1965. Washington, U. S. Govt. Print. Off., 1967. 188 pp.
Statistics showing overall pattern of R & D distribution geographically, Federal and non-Federal sites, distribution by intramural, industrial, and educational category, and distribution by agency.

U. S. National Science Foundation.
Graduate student support and manpower resources in graduate science education. Analysis of student enrollments, sources of student support, and faculty and postdoctorals in graduate science departments, 1965-66. Washington, U. S. Govt. Print. Off., 1968. 112 pp.

U. S. National Science Foundation.
The junior college and education in the sciences. Report...to the Committee on Science and Astronautics... Washington, U. S. Govt. Print. Off., 1967. 103 pp. (H. comm. print, 90th Cong.)

U. S. National Science Foundation.
National patterns of R & D resources; funds and manpower in the United States. Washington, U. S. Govt. Print. Off., 1967. 26 pp. (NSF 67-7)
Summary of trends in U. S. expenditures and employment in research and development from 1953 to 1965 with estimates to 1968. Includes statistical data on employment of scientists and engineers, 1954-1965.

U. S. National Science Foundation.
The prospective manpower situation for science and engineering staff in universities and colleges, 1965-75. Washington, U. S. Govt. Print. Off., 1967. 25 pp. (NSF 67-11)

U. S. National Science Foundation.
R & D activities in state government agencies, fiscal years 1964 and 1965. Washington, U. S. Govt. Print. Off., 1968. 68 pp. (NSF 67-16)
Chapter 2 , "R & D personnel in state agencies," covers general characteristics, character of work, field of science and functional area. Tables B-28--B-32 show statistics on scientists and technicians.

Supply and Demand for Technical Personnel (Cont'd)

U. S. National Science Foundation.
R and D activities of local governments, fiscal years 1966 and 1967. Washington, U. S. Govt. Print. Off., 1969. 60 pp. (Surveys of science resources series, NSF 69-14)

Includes local government expenditures by category, R and D personnel in local governments, and comparisons with the Federal government.

U. S. National Science Foundation.
R and D in the aircraft and missiles industry, 1957-68. Prepared by Office of Economic and Manpower Studies. Washington, U. S. Govt. Print. Off., 1969. 17 pp. (NSF 69-15)

Data on scientists and engineers in aircraft and missile companies, pp. 7-8.

U. S. National Science Foundation.
Research and development in industry, 1966. A final report on a survey of R & D funds, 1966, and R & D scientists and engineers, Jan. 1967. Washington U. S. Govt. Print. Off., 1968. 134 pp. (Surveys of science resources series, NSF 68-20)

Detailed statistics cover funds allocated to R & D in Federal government and industry from 1953 to 1966, employment of R & D scientists and engineers up to January 1967 and R & D expenditures in three leading industries.

Preliminary data for 1967 appears in Reviews of Data on Science Resources, no. 17, February 1969.

U. S. National Science Foundation.
Scientific activities at universities and colleges, 1964. A final report on a survey of 1964 financing and January 1965 employment in the sciences and engineering. Washington, U. S. Govt. Print. Off., 1968. 96 pp. (Surveys of science resources series, NSF 68-22)

Includes data on the number and fields of science of scientists and engineers employed in universities and colleges and in Federally funded research and development centers administered by universities.

U. S. National Science Foundation.
Scientific activities of nonprofit institutions, 1966. 1966 expenditures and January 1967 manpower. Washington, U. S. Govt. Print. Off., 1969. 82 pp. (Surveys of science resources series NSF 69-16)

Includes data on employment of scientists and engineers, employment of technicians, and manpower characteristics of various categories of nonprofit institutions.

U. S. National Science Foundation.
Scientists, engineers, and physicians from abroad, fiscal years 1966 and 1967. Washington, U. S. Govt., Print. Off., 1969. 31 pp. (Surveys of science resources series, NSF 69-10)

Covers extent and characteristics of immigration into the United States. Data on occupations, country or region of birth and of last permanent residence, migration patterns, age, sex, etc.

U. S. National Science Foundation.
Summaries of studies concerning scientific and technical manpower and education as of June 30, 1968. Compiled ... from reports of selected Federal agencies. Washington, 1969. 155 pp.

For each study listed information given includes title, performing organization, sponsoring organization, description and status of the projects.

Supply and Demand for Technical Personnel (Cont'd)

U. S. National Science Foundation.
Toward a public policy for graduate education in the sciences. Prepared by National Science Board. Washington, U. S. Govt. Print. Off., 1969. 63 pp.

Tables show distribution of graduate enrollments in science and engineering by type and size of institution; graduate enrollments and doctorate awards in science and engineering, by state, and by metropolitan areas of 500,000 or more.

Wallenstein, Gerd D.
Fundamentals of technical manpower planning. New York, American Management Association, Research and Development Division, 1966. 30 pp. (AMA management bulletin 78)

Shows that a system of manpower planning can best be based on an analysis of a company, then discusses questions raised by a synthesis of planning future manpower needs. This synthesis involves defining technical manpower needs, professional advancement, training, recruiting, providing leadership, planning the technical group environment, and a coordination with overall planning.

Washington University. Department of Economics.
The shortage of scientists and engineers, by Hugh Folk. St. Louis, Mo., 1968. 384 pp. (Working paper, no. 6802)

Examines the labor market for scientists and engineers, the eight types of shortages, earnings, and outlook.

Washington University. Department of Economics.
The supply of engineers and scientists, by Hugh Folk. St. Louis, Mo., 1965. 50 pp. (Working paper no. 6506).

Presents data on trends in engineering and science enrollments and degrees, on earnings, on patterns of occupational choice after training and on undergraduate engineers.

What's needed to solve the engineering crisis (special report no. 8). Business management, vol. 32, no. 1, April 1967, pp. 75-80.

Article cites the continuing shortage of engineering personnel and the causes of rising emphasis on technical workers. Thirteen steps for putting engineering manpower to better use are proposed.

Worsnop, Richard L.
World competition for skilled labor. Editorial research reports, vol. 1, no. 23, June 21, 1967, pp. 441-457.

Immigration of skilled personnel to the United States has created a shortage of professional people in many other countries. Article provides data on immigration of skilled persons from 1949 to 1966 and indicates current and proposed legislation limiting entry and setting up better exchange programs.

Wright, Lee.
Needed: more Negro engineers and technicians. Professional engineer, vol. 38, no. 9, September 1968, pp. 61-65.

A look at what engineers in Topeka, Kansas, are doing to help bring minority groups students into the engineering profession and suggestions for actions that might be taken.

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PERSONNEL MANAGEMENT FOR SCIENTISTS AND ENGINEERS IN THE FEDERAL GOVERNMENT

MAJOR STUDIES AND REPORTS

Note: Items listed below without annotations are described more fully in appropriate subject matter sections, i.e., pay, supply and demand, etc. Items prior to 1965 may be found in Personnel Bibliography no. 15 of the same title (1965).

Dysinger, Dale W.
Motivational factors affecting Army research and development personnel. Alexandria, Va., Defense Documentation Center, 1966. 62 pp. (Technical research report 1149, contract no. DA 49-092-ARO-32)

Little, Arthur D., Inc.
Management factors affecting research and exploratory development. Alexandria, Va., Defense Documentation Center, 1965. 1 v.

Marcson, Simon.
Scientists in government; some organizational determinants of manpower utilization in a government laboratory. New Brunswick, N. J., Rutgers University, 1966. 595 pp.

Strauss, Paul S.
Job satisfaction, productivity and job activities of Federal engineers and scientists; an application of growth and belonging theory. Ann Arbor, Mich., University Microfilms, Inc., 1966. 183 pp.

U. S. Civil Service Commission.
Functional classification system for scientists and engineers. Prepared by Bureau of Policies and Standards. Washington, 1966. 21 pp.

U. S. Civil Service Commission.
Scientists and engineers in the Federal personnel system. Prepared by Bureau of Policies and Standards. Washington, U. S. Govt. Print. Off., 1968. 1 v.

U. S. Civil Service Commission.
University-Federal Agency Conference, Bloomington, Indiana, November 7-10, 1965. Washington, 1965. 2 v. in 1

U. S. Congress. House. Committee on Science and Astronautics.
Utilization of Federal laboratories. Report ... Washington, U. S. Govt. Print. Off., 1968. 68 pp. (H. comm. print. 90th Cong.)

U. S. Department of Defense.
A comparative study on characteristics and compensation of military officers in research, development, test and evaluation. Prepared by Milton Gussow, Office of the Director of Defense Research and Engineering. Washington, 1966. 129 pp. (Management analysis report 66-4)

U. S. Department of Defense.
Comparison of 1968 DOD and national surveys of compensation paid to scientists and engineers, by E. M. Glass, Office of the Director of Defense Research and Engineering, Office for Laboratory Management. Washington, 1969. 46 pp. (Management analysis report 69-3)

Major Studies and Reports (Cont'd)

U. S. Department of Defense.
A comparison of salaries paid to scientists and engineers by Defense laboratories and by private industry, by Frank A. Nicolai, Office of the Director of Defense Research and Engineering. Alexandria, Va., Defense Documentation Center, 1965. 23 pp. (Management analysis note, 65-1).

U. S. Department of Defense.
Grade and salary distribution of selected DOD in-house laboratories. Report of the Department of Defense Task 97 Action Group. Alexandria, Va., Defense Documentation Center, 1965. 68 pp.

U. S. Department of Defense.
Joint program of the Civil Service Commission and the Department of Defense to resolve problems in the management of Defense in-house laboratories. Prepared by Office of the Director of Defense Research and Engineering, Office for Laboratory Management. Washington, 1969. 65 pp. (Management analysis memorandum 69-2)

U. S. Department of Defense.
Problems of the in-house laboratories and possible solutions. Alexandria, Va., Defense Documentation Center, 1966. 63 pp. (Management analysis memorandum 66-3)

U. S. Department of Defense.
Profile of civilian scientists and engineers in field RDT&E activities of the Department of Defense, by E. C. Haberman and E. M. Glass, Office of the Director of Defense, Research and Engineering, Office for Laboratory Management. Washington, 1969. 25 pp. (Management analysis report 69-1)

U. S. Department of Health, Education, and Welfare.
Report of the Career Service Board for Science..., December 23, 1968. Washington, U. S. Govt. Print. Off., 1969. 1 v.

U. S. Department of the Air Force.
Applications of the behavioral sciences to research management: an initial study in the Office of Aerospace Research, by Howard M. Vollmer, Office of Aerospace Research. Washington, 1964. 86 pp.

U. S. Federal Council for Science and Technology. Committee on Federal Laboratories.
Catalog of Federal laboratory-university programs and relationships. Report ... to Office of Science and Technology, Executive Office of the President. Washington, U. S. Govt. Print. Off., 1969. 76 pp.

Major Studies and Reports (Cont'd)

U. S. Federal Council for Science and Technology.
Education and Federal laboratory-university relationships. Proceedings /of/ symposium on... October 29-31, 1968. Washington, U. S. Govt. Print. Off., 1969. 251 pp.

U. S. Federal Council for Science and Technology.
Education and the Federal laboratories; an assessment of Federal laboratory educational activities and their present and potential relationships with universities. Prepared by Committee on Federal Laboratories. Washington, 1968. 90 pp.

U. S. Federal Council for Science and Technology.
The environment for quality; a report on the identification and evaluation of employment features important to the recruitment, retention, and effective utilization of superior scientists and engineers in the Federal service. Prepared by the Standing Committee. Washington, 1966. 1 v.

U. S. Federal Council for Science and Technology.
The environment of the Federal laboratory. Proceedings of Third Symposium, December 7-8, 1964. Washington, U. S. Govt. Print. Off., 1965. 125 pp.

U. S. Federal Council for Science and Technology.
Management and the marginal employee; an analysis of personnel practices to prevent and treat the problem. Washington, 1966. 15 pp.

U. S. Library of Congress. Legislative Reference Service.
A case study of the utilization of Federal laboratory resources. A study submitted to the Research and Technical Programs Subcommittee of the Committee on Government Operations, prepared by Science Policy Research Division... Washington, U. S. Govt. Print. Off., 1966. 141 pp. (H. comm. print, 89th Cong.)

U. S. National Aeronautics and Space Administration.
A study of NASA university programs. Prepared by Task Force to Assess NASA University programs. Washington, U. S. Govt. Print. Off., 1968. 79 pp. (NASA SP-185)

Vollmer, Howard M. and William C. Pedersen.
The role and career development of the scientific and engineering officer in the Air Force. Menlo Park, Calif., Stanford Research Institute, 1966. 82 pp. (R & D studies series)

PERSONNEL MANAGEMENT FOR SCIENTISTS AND ENGINEERS IN THE FEDERAL GOVERNMENT

RECRUITMENT, SELECTION AND TRAINING

Beebe, Betty L.
A review of a successful recruitment program. Washington, 1967. 1 v.
Outlines steps taken in 1967 by U. S. Naval Ordnance Laboratory, White Oak, Maryland, to avoid a critical shortage of physical scientists. Personnel Management for Personnel Specialists course, October 1967.

Beresford, Spencer M.
Lawyers, science, and the government. George Washington law review, vol. 33, no. 1, October 1964, pp. 181-208.
Speaks of increasing number of lawyers' transactions with government officials, particularly in the form of mediation between science and its chief sponsor, the Federal government, or in the form of decision-making by lawyer-administrators. Considers importance of role of scientists in government and describes both scientists and lawyers as professional specialists, making some comparison between them. Concludes with reference to need for careful selection and training for government service, and notes needed qualifications in abilities, personality, education, and knowledge of politics and of science.

Cobb, V. Wayne
The mid-career and senior Federal research and development employee. In U. S. Civil Service Commission. University-Federal Agency Conference, Bloomington, Indiana, November 7-10, 1965. Washington, 1965, pp. 17-31.
"The second paper describes in comprehensive fashion, utilizing statistical and graphical techniques, the background and career progression of 22,230 mid-career R & D employees (GS-13-15) and 757 senior personnel (GS16-18)."

College Federal Council for Southern California.
Sabbatical employment opportunities for college faculty members 1968-1969. n.p., 1968. 86 pp.
Each position indicates specialty sought, project description, salary, agency, etc.

Cywin, Allen.
Engineers are second-class citizens in terms of high-level government jobs. Professional engineer, vol. 39, no. 6, June 1969, pp. 43-46.
Decries the dearth of professional engineers in top Federal jobs. Feels that the engineer should show concern for the public interest and share its responsibilities. Expresses the opinion that lack of participation in public affairs might well be a reasons for the slackening interest of students in engineering careers.

Danhof, Clarence H.
Government contracting and technological change. Washington, Brookings Institution, 1968. 472 pp.
For scientific and technical personnel the following topics are discussed: problems of recruitment by government, employment in U. S. sponsored research overseas, salary differentials in private and public agencies, recognition of accomplishment, and ownership in new knowledge.

Recruitment, Selection and Training (Cont'd)

deNeufville, Richard.
White House Fellowship; a year at the top. Civil engineering, October 1966.
A civil engineer recounts his experiences in the White House Fellows Program and calls on the engineering profession to be more responsive to the needs of the Federal government and society in both the technical and non-technical areas.

Eiduson, Bernice T.
Scientists as advisors and consultants in Washington. Bulletin of the atomic scientists, vol. 22, no. 8, Oct. 1966, pp. 24-25.
"...a report on a study of forty scientists who have served as advisors or consultants to government, and in particular, how they themselves view their roles--and effectiveness."

Gill, Thomas W.
Continuing education at NOL. Training directors journal, vol. 19, no. 2, February 1965, pp. 8-13.
Report on programs of professional education primarily at the graduate level in science and management for employees of the Naval Ordnance Laboratory in Silver Spring, Maryland. Reviews background of the programs, describes how need for courses is determined and scheduling is carried out. Presents chart showing types of programs, admittance, support, and continuing service required.

Gill, Thomas W.
How White Oak Naval Lab updates senior scientists. Training in business and industry, vol. 4, no. 11, November 1967, pp. 30-31.
Report on training opportunities for employees in grade GS-14 or above in either supervisory or technical positions.

Halset, Walter G.
The paradoxes of public administration. Public personnel review, vol. 26, no. 2, April 1965, pp. 66-69.
Because scientists and engineers are usually untrained in public administration, they are often confused and exasperated as government employees. A training program to aid the scientist or engineer in understanding his environment as a government employee is herein described. Its second phase is concerned with value systems of government, many of which are in conflict. Examples presented are: efficiency vs. public protection; unified vs. decentralized control; minority value vs. majority value.

Huddleston, Robert H.
Preferential treatment of veterans as a factor in the employment of engineers and scientists in the Federal government. Washington, U. S. Industrial College of the Armed Forces, 1966. 61 pp. (Student research report no. 78)
Study is limited to the effect of veterans' preference legislation on the competitive appointment system. The author is an employee of the National Aeronautics and Space Administration.

Recruitment, Selection and Training (Cont'd)

Hudson, John B.
Management's critical challenge--people. Air University review, vol. 20, no. 2, January-February 1969, pp. 60-70.
An account of programs of the Air Force Systems Command for recruiting, training and retaining its military and civilian scientific and engineering talent.

Is the engineer a second-class citizen in terms of high-level government jobs? Professional engineer, vol. 39, no. 5, May 1969, p. 25.
Fourteen questions on certain aspects of the engineering profession are asked of readers. Sample questions are: "Do you feel that engineers, as a group, are as well prepared as, say, lawyers to handle 'big picture' decisions?" "Are professional engineers sufficiently represented in top Federal agency positions?" and "If engineers in industry and consulting should seek top government jobs, what about those already in Civil Service? Should they risk their status by taking political appointments?" Replies to the questions may be published in a later issue.

Joint Advisory Committee on Continuing Engineering Studies.
A report ... considering the roles of industry, government, academic institutions, engineering societies. Washington, 1965. 1 v. (Revised draft 9-16-65)
Synopsis of task force reports as well as the individual ones. Report of the Government Task Force discusses the interest of the government in continuing education, provides a profile of the educational background of engineers in the Federal service and gives a run-down of opportunities for continuing engineering study in the Federal establishment.

Leich, Harold H.
Scientists and engineers in a civil service system. Public personnel review, vol. 26, no. 1, January 1965, pp. 35-39.
Describes ways Federal merit system is being changed to meet needs of professional, scientific and technical personnel. These changes cover such personnel considerations as pay, recruiting and examining and opportunities for career development, creativity and recognition.

Machine Design (periodical).
Why work for the government? Machine design, vol. 38, no. 21, September 15, 1966, pp. 169-172.
Findings of a survey of 500 working level engineers and 500 supervisory-management engineers indicate feelings pro and con government employment, what motivates an engineer to work for the government, and opinions regarding the competency of engineers in government and in private industry.

Recruitment, Selection and Training (Cont'd)

Macy, John W., Jr.
The scientist in the Federal service. Science, vol. 148, no. 3666, April 2, 1965, pp. 51-54.
Reviews positive factors in the Federal personnel system for scientists: incentive awards, training, merit promotion, salary reform, recruitment for quality, classification of positions, and a creative environment. Concludes, however, that there are additional, even more significant factors that attract the scientist to government employment; challenging scientific missions, an impartial and scientific environment, freedom from involvement in scientific trivia; good equipment and respected colleagues, and an opportunity to render service to the nation.
Also reprinted in the Civil Service Journal, vol. 5, no. 4, April-June 1965, pp. 22-25.

Mattfeld, Jacquelyn A. and Carol G. Van Aken, eds.
Women and the Scientific Professions; the M.I.T. symposium on American women in science and engineering. Cambridge, M.I.T. Press, 1965. 250 pp.
Partial contents: Government interest in the employment of women, Robert F. Mello.

Medina, William A.
Recruitment and career development of entry-level Federal scientists and engineers. In U. S. Civil Service Commission. University-Federal Agency Conference, Bloomington, Indiana, November 7-10, 1965. Washington, 1965, pp. 5-15.
Paper covers factors affecting recruitment of entering personnel; statistical figures of acceptances and declinations of offers of Federal employment and on the number and quality of entry-level engineers, mathematicians and scientists, 1961-1964; career development opportunities for the entering scientist or engineer, and types of social science research being conducted on entry-level professionals.

NASA's lady scientists meet space challenge. Federal times, vol. 1, no. 15, June 9, 1965, pp. 6, 7.
National Aeronautics and Space Administration's women scientists and administrators are busy with significant and interesting work in the space program. Article describes the work, background, and interests of some of these ladies.

Park, Chung Soo.
Government by contract: its implications for Federal personnel administration. Ann Arbor, University Microfilms, Inc., 1965. 262 pp.
"Most of the materials available for reference pertained to R & D contracting out... Therefore, the study mainly focused its investigation on that area and information for the study was largely drawn therefrom."

Recruitment, Selection and Training (Cont'd)

Presidential Task Force on Career Advancement.
Self and service enrichment through Federal training. Selections from studies, reports and papers.... Washington, U. S. Govt. Print. Off., 1967. 577 pp.
Partial contents: The industrial experience: continuing education for scientists and engineers in Federal service, by Melvin W. Wachs, pp. 192-214; Meeting manpower needs in science and technology: engineering technician training, by the President's Science Advisory Commission, pp. 214-232; Education of technicians for career advancement, by Robert M. Knoebel, pp. 232-236; Technician training: some problems and proposals, by Henry M. Rosenstock and Milton D. Scheer, pp. 236-243; Training for specialization in the biomedical sciences, pp. 244-257; Continuing education for scientists and engineers in Federal service: the universities, by Melvin W. Wachs, pp. 344-366.

Ragan, William M., Jr.
Exhibit on Federal science and engineering. Civil service journal, vol. 5, no. 4, April-June 1965, pp. 2-8.
"This is the story of how the cooperative efforts of scores of people in the Federal service, industry, and education were pooled to produce the first coordinated visual presentation of the productive partnership of science and Government in the Nation's service."

Resource Publications.
Engineering careers in government; a directory of full-page profiles featuring descriptive presentations of Federal, state, and local government agencies seeking engineering and technical personnel. Princeton, N.J., 1968. 160 pp.
Arranged by agency giving for each kinds of research programs, employment opportunities, location and facilities, special features and attractions.

Rose, Henry R.
How do you manage recruiting of scientific personnel?" In U. S. Federal Executive Board (Boston). How do you manage? A symposium presented by Management Improvement Committee. Boston, 1964, pp. 4-7.
The Civilian Personnel Officer at the U. S. Army Natick Laboratories describes his recruiting techniques for all levels of Federal scientists.

Smith, Olie O.
Problems faced in recruiting engineers for the Federal service. Washington, 1967. 5 pp.
Paper prepared for Personnel Management for Personnel Specialists course, June 1967.

Torpey, William G.
An inter-Federal agency approach to scientific and technical manpower for state and local government. Public personnel review, vol. 30, no. 3, July 1969, pp. 174-177.
Lists steps taken and steps proposed by various Federal agencies to help state and local governments in the development of scientific and technical personnel.

Recruitment, Selection and Training (Cont'd)

U. S. Civil Service Commission.
The big pond; Federal jobs for engineers, physical scientists, mathematicians. Prepared by Bureau of Recruiting and Examining, Program Development Division. Washington, U.S. Govt. Print. Off., 1969. 15 pp.
Recruitment brochure which points out advantages of working for a large organization, tells where the jobs can be found, and notes benefits of government employment.

U. S. Civil Service Commission.
Current Federal workforce data as of December 1966 and June 1967. Washington, U. S. Govt. Print, Off., 1968.
Employment, turnover and hiring data for fiscal year 1967 is provided. Covers 152 occupational series including biologists, engineers, agricultural and physical scientists.

U. S. Civil Service Commission.
Federal workforce outlook; fiscal years 1968-1971. Washington, U. S. Govt. Print. Off., 1968.
Provides a four-year employment projection for each of the 152 occupational series, including biologists, engineers, agricultural and physical scientists.

U. S. Civil Service Commission.
Functional classification system for scientists and engineers. Prepared by Bureau of Policies and Standards. Washington, 1966. 21 pp.
Classification to "provide a structural foundation for the periodic compilation of data as to number of scientists and engineers in the Federal service engaged in functions such as research, development, construction, teaching and training, etc. ... This new information will assist agencies in the analysis and evaluation of manpower utilization, in the projection of manpower requirements, and in the development of policies dealing with manpower resources. It will also have value in development of educational and training programs to meet projected demands." Covers professional personnel in the physical, biological, mathematical, social, and health sciences and in engineering.

U. S. Civil Service Commission.
Science administration, education, and career mobility. Summary of proceedings and working papers of the University-Federal agency conference sponsored by Purdue and Indiana Universities for the U. S. Civil Service Commission, November 7-9, 1965. Bloomington, Indiana, Indiana University, Institute of Public Administration, 1966. 93 pp.
Focuses on mid-career training and educational needs of Federal scientists. Working papers,"A profile of the Federal research and development workforce,"include: Recruitment and career development of entry-level Federal scientists and engineers; The mid-career and senior Federal research and development employee; The Federal laboratory, scientific and technical director.

Recruitment, Selection and Training (Cont'd)

U. S. Civil Service Commission.
Science and engineering careers in government; descriptions of beginning jobs for young people. Washington, U. S. Govt. Print. Off., 1967. 21 pp.

U. S. Civil Service Commission.
Scientists and engineers in the Federal personnel system. Prepared by Bureau of Policies and Standards. Washington, U. S. Govt. Print. Off., 1968. 1 v.

Describes special features and flexibilities of the Federal personnel system available to insure quality staffing of government laboratories. Covers recruitment procedures, special salary rates for superior candidates, appointment options for short projects, and opportunities for training, recognition, and a creative environment.

U. S. Civil Service Commission.
The vision of man; an exhibit of Federal science and engineering. Washington, U. S. Govt. Print. Off., 1965. folder.

Explanatory brochure on exhibit.

U. S. Department of the Air Force.
Applications of the behavioral sciences to research management: an initial study in the Office of Aerospace Research, by Howard M. Vollmer, Office of Aerospace Research. Washington, 1964. 86 pp.

V. Recruitment, retention, and utilization of scientists. Discusses how research organizations commonly go about recruiting or obtaining competent scientists, how they attempt to retain them, and how they attempt to place them within the organization and reward them in ways that induce and sustain scientific productivity.

U. S. Department of the Interior.
Departmental personnel conference. Albuquerque, New Mexico, October 16-19, 1967. Washington, 1967. 121 pp.

Includes session on "Scientific and technical manpower problems in Interior," pp. 76-77.

U. S. Department of the Interior.
Manpower for environmental and natural resource management. Statistics, 1967. Complied by Office of Personnel Management, Office of the Assistant Secretary for Administration. Washington, 1967. 55 pp. (Personnel management publication 12)

Manpower statistics and major trends, generally from 1957-1967, with some projections into future. Includes grade levels, minority group employees, women, handicapped, separations, quality increases, employee-management cooperation, safety, etc.

Recruitment, Selection and Training (Cont'd)

U. S. Department of the Navy.
Navy-wide training agreement, scientists and engineers. Prepared by Office of Civilian Manpower Management. Washington, 1968. 40 pp. (NAVSO P-3061-1)

Training agreement, representative position descriptions and training program outline for nation-wide training agreement for scientists and engineers at the GS-5 and GS-7 levels for development and advancement to the GS-7 and GS-9 levels.

U. S. Federal Council for Science and Technology. Committee on Federal Laboratories.
Catalog of Federal laboratory-university programs and relationships. Report ... to Office of Science and Technology, Executive Office of the President. Washington, U. S. Govt. Print. Off., 1969. 76 pp.

"A description of the many types of training programs and cooperative relationships that exist among Federal laboratories and contract centers and universities."

U. S. Federal Council for Science and Technology.
Education and Federal laboratory-university relationships. Proceedings /of/ symposium on... October 29-31, 1968. Washington, U.S. Govt. Print. Off., 1969. 251 pp.

Partial contents: Use of Federal facilities for training university graduate students; Formal education and training programs for laboratory professional staff; Joint research activities involving university and Federal personnel; Interchange of professional personnel between universities and Federal laboratories.
Co-Sponsor: American Council on Education.

U. S. Geological Survey.
Personnel administration geared to professional staffing. An orientation for college and university faculties and placement officials. Denver, Colorado, Rocky Mountain Area, 1967. 1 v.

Recruiting pamphlet directed to college and university staffs and students, with emphasis on streamlined procedures, minimal paperwork, and expedient placement of scientific and engineering personnel.

U. S. National Aeronautics and Space Administration.
A study of NASA university programs. Prepared by Task Force to Assess NASA University programs. Washington, U. S. Govt. Print. Off., 1968. 79 pp. (NASA SP-185)

This study examines results of the total NASA university program. It determines returns to NASA, the universities and the Nation, assesses these returns, and suggests alternatives that would increase benefits to each party. Chapter 5, "Personnel development programs," examines graduate training, short courses and seminars, cooperative work-study programs, summer faculty fellowship programs (two case studies) and the NASA-NRC Resident Research Associateship Program.

Recruitment, Selection and Training (Cont'd)

U. S. National Bureau of Standards.
Evaluation of long-term training program. Washington, 1966. 5 pp.
Series of questions and answers weighing the effectiveness of the long-term training program for the period 1961-64. "The general impression is that this is a highly successful program, is a great asset to the Bureau, and an attraction to Government service...."

Wachs, Melvin W.
Mobility of scientists and engineers in the Federal establishment. In National Conference on Mobility in the Public Service. Background papers for discussion at conference conducted by American Society for Public Administration, Arden House, March 1966. Washington, 1966. 29 pp.
Discusses mobility patterns at entry, mid-career and at Federal laboratory director levels; considers mobility between Federal and private sectors, between Federal-state-local sectors; and includes data on short-term exchanges with academic personnel.

Will, John and Reuben Pomerantz.
A science and technology fellowship program. Civil service journal, vol. 5, no. 3, January-March 1965, pp. 19-20.
Account of a program set up by the U. S. Department of Commerce as an opportunity for technically trained employees to broaden their backgrounds and perspectives through participation in career management programs. Describes selection of participants and elements of curriculum.

NOTE: See also section on "Selecting and Developing Technical Personnel for Management Responsibilities" for additional references on Federal government personnel practices.

PERSONNEL MANAGEMENT FOR SCIENTISTS AND ENGINEERS IN THE FEDERAL GOVERNMENT

SALARY ADMINISTRATION FOR SCIENTISTS AND ENGINEERS

Glass, E. M.
Institutional analysis of compensation for scientists and engineers. IEEE transactions on engineering management, vol. EM-13, no. 1, March 1966, pp. 41-62.

Summary of the first comprehensive analysis of compensation patterns of scientists and engineers in RDT&E installations of the Department of Defense. Examines such factors as size, type of mission, geographical location, and educational levels to determine their effect on the characteristics and nature of institutional grade and salary distribution.

Herschler, D. Marc.
Salary; its significance in recruiting engineers and scientists for the Federal government. Washington, 1967. 8 pp.

Prepared for Personnel Management for Personnel Specialists course, June 1967.

Howell, Richard P., Martin Gorfinkel, and Dale Bent.
Individual characteristics significant to salary levels of engineers and scientists. Alexandria, Va., Defense Documentation Center, 1966. 101 pp.

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An approach to estimating the cost of the proposal to raise allowances of high-grade positions for DOD laboratories, by Frank A. Nicolai, Office of the Director of Defense Research and Engineering. Alexandria, Va., Defense Documentation Center, 1965. 2 pp. (Management analysis memorandum 65-2)

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A comparative study on characteristics and compensation of military officers in research, development, test and evaluation. Prepared by Milton Gussow, Office of the Director of Defense Research and Engineering. Washington, 1966. 129 pp. (Management analysis report 66-4)

Describes characteristics (designator, rank, age, education and compensation) of Navy-officer population working in research, development, test and evaluation. Compares the characteristics to those of Air Force officers working in the same areas, and of civilian scientists and engineers in Defense laboratories and in the aerospace industry. Analyzes the data and presents recommendations.

Salary Administration for Scientists and Engineers (Cont'd)

U. S. Department of Defense.
Comparison of 1968 DOD and national surveys of compensation paid to scientists and engineers, by E. M. Glass, Office of the Director of Defense Research and Engineering, Office for Laboratory Management. Washington, 1969. 46 pp. (Management analysis report 69-3)
Compares the findings of two salary surveys,one by the Battelle Memorial Institute, 1968 National survey of compensation paid to scientists and engineers in research and development, 31 January 1969; and, one by the Department of Defense, 1968 DoD Survey of compensation paid to scientists and engineers, 1 July 1969.

U. S. Department of Defense.
Comparison of rank correlations concerning salary, size of staff and degree level, by Frank A. Nicolai, Office of the Director of Defense Research and Engineering. Alexandria, Va., Defense Documentation Center, 1965. 4 pp. (Management analysis memorandum 65-1)
Survey covered seven Navy labonatories and 37 private companies on which data had been previously collected. The conclusion: "... In the private companies, people with high degrees are better compensated in relation to those with low degrees than their counterparts in the Navy laboratories."

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A comparison of salaries paid to scientists and engineers by Defense laboratories and by private industry, by Frank A. Nicolai, Office of the Director of Defense Research and Engineering. Alexandria, Va., Defense Documentation Center, 1965. 23 pp. (Management analysis note, 65-1)
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Grade and salary distribution of selected DOD in-house laboratories. Report of the Department of Defense Task 97 Action Group. Alexandria, Va., Defense Documentation Center, 1965. 68 pp.
Partial contents: Factors affecting the number of high grades in laboratories.

U. S. Department of the Navy.
Civilian/military compensation study, by Simon Arzigian, U. S. Naval Personnel Research Activity. Alexandria, Va., Defense Documentation Center, 1962. 44 pp. (Task assignment 31.4-1 WRS-62-25)
Includes table of military and civilian grade equivalents; salary offers for civil engineers, accountants, etc., and officer-civilian comparability for engineers and accountants.

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Minnesota. University. Industrial Relations Center.
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Science and engineering management; a selected and annotated bibliography of research, development and engineering management literature. Dayton, Ohio, 1964. 26 pp.

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Scientists, engineers and managers in research and development; concepts, organization, recognition, environment, development. Selected bibliography, by Lester L. Dever and Jack H. Epstein. Washington, Andrews Air Force Base, 1965. 22 pp.

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Sources of unclassified information on U. S. Government research and development. Prepared by Office of Naval Research. Alexandria, Va., Defense Documentation Center, 1967. 20 pp.
"This pamphlet contains a summary of readily available sources of unclassified U. S. Government research and development information together with a brief discussion of the recently adopted microfiche system designed to reduce the volume, weight and cost of U. S. government reports and other documents."

GENERAL ASPECTS

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Berggren, Willard P.
Guidebook for engineering newcomers to the United States of America, with a word to employers. New York, Engineers Joint Council, 1968. 61 pp.
Partial contents: Professional opportunity and recognition; Work conditions and professional adjustment; Legal and welfare questions; Engineering salaries in the U. S.

Bevans, M. J.
Technical personnel: managing this 'elite' corps. Administrative management, vol. 29, no. 11, November 1968, pp. 20-21.
Outlines procedures for smoothing the relationship of managers with their technical employees: by provision of facilities and equipment meeting professional standards, in providing flexible work schedules, and by encouraging professional memberships.

Brown, Harry W.
Optimize engineering turnover. American engineer, vol. 38, no. 1, January 1968, pp. 24-27.
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Chipman, L. D.
How effective are your engineering personnel relations? Professional engineer, vol. 39, no. 10, October 1969, pp. 30-36.
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De Blasio, A.
Personnel practices and problems in research facilities. Journal of the College and University Personnel Association, vol. 19, no. 3, May 1968, pp. 44-58.
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Hinrichs, John R.
High-talent personnel; managing a critical resource. New York, American Management Association, Inc., 1966. 288 pp.

A scrutinizing look at the supply and demand for high talent manpower and manpower planning. Examines the recruitment, utilization, and development of scientists and creative personnel.

Jackson, Thomas W. and Jack M. Spurlock.
Research and development management. Homewood, Ill., Dow Jones-Irwin, Inc., 1966. 232 pp.

Identifies the three types of research: fundamental, applied, developmental. Provides guidelines for establishing a research organization and for staffing it. There are sections on qualities of a researcher, recruiting and interviewing, cost of maintaining a researcher and on motivating and encouraging creativity.

Jay, Richard A.
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Partial contents: Engineering manpower planning, by George T. Lewis and Maurice Feldmann; The effect of corporate mergers on engineering manpower, by Marlowe G. Moses; The development and use of skills inventory as an aid to engineering manpower planning and utilization, by O. J. Krasner; Productivity of sources of engineering talent in the current market, by J. C. Older; Readiness of the company--factors for successful recruiting, by Robert K. Johnson; Using people effectively, by James G. Ripley; Managing and motivating engineers, by Michael Beer; Using technicians to supplement engineering talent, by Roger P. O'Reilly; Promoting turnover and mobility, by Norman Lieblich.

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Karger, Delmar W. and Robert G. Murdick.
Managing engineering and research; the principles and problems of managing the planning, development and execution of engineering and research activities. New York, The Industrial Press, 1963. 693 pp.
Partial contents: Staffing the E & R organization; Developing and training personnel; Developing creative engineering; Compensating and rewarding technical personnel; Measurement of E & R; Managing the electronic computer center; From engineer to manager; Guidelines for professional conduct; Appendix 30A: Unionization of professional and technical employees.

Kaufman, H. G. and R. R. Ritti.
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Report of part of a continuing investigation. "The evidence analyzed ...indicates that strong product identification combined with local management assists in creating the 'best' overall morale and decision-making climate for engineering development laboratories."

Kay, Hubert.
Harnessing the R. and D. monster. Fortune, vol. 71, no. 1, January 1965, pp. 160-163, 196, 198.
Consideration of problems of research administration among which are employing effective managers and the temperament of employee-scientists.

Kipp, Egbert M.
People aspects; attracting and retaining R and D personnel. New York, Gordon and Breach Science Publishers, 1967. 104 pp.
Suggestions on how to build a job situation which the scientist views as challenging, attractive, and rewarding. Considers such factors as the R and D establishment's organization and policies, salary administration, personnel development, utilization of the scientist's work, human relations, and introducing the new scientist and the new scientific employee to industrial research.

Kirban, Lloyd.
The role of pre-employment job orientation in voluntary termination. Ann Arbor, Mich., University Microfilms, Inc., 1966. 113 pp.
Reports an investigation of engineering graduates to determine the effect of pre-employment job orientation on job satisfaction.
Doctoral dissertation, New York University, 1965. Abstracted in Dissertation Abstacts, vol. 27, no. 1, July 1966, p. 21A.

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An evaluation of a suggested method for measuring the effectiveness of the utilization of technically trained personnel. Monterey, Calif., U. S. Naval Postgraduate School, 1965. 70 pp.
Masters thesis, U. S. Naval Postgraduate School, 1965.

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Kruytbosch, Carlos E. and Sheldon L. Messinger.
Unequal peers: the situation of researchers at Berkeley. American behavioral scientist, vol. 11, no. 5, May-June 1968, pp. 33-43.
Findings of a survey of researchers at the University of California, Berkeley in 1966. The study was sponsored by the Research Committee of the Academic Research and Professional Association and covered such areas as status, background and orientation, organizational characteristics and participation in university functions. Results indicate lack of formal protection and certain slights and lead one to question whether the creation of knowledge should not be accorded the same recognition as it transmission.

Lavoie, Francis J.
Now--a program for lending engineers. Management review, vol. 58, no. 8, August 1969, pp. 45-48.
LEND (Lockheed Engineers for National Deployment) is a device for "leasing" temporarily unneeded engineers and designers to other companies in an effort to compensate for fluctuations in engineering-manpower requirements. The Lockheed program has not only added to employment stability, it has also helped to reduce turnover and given their engineers valuable work experience when they might otherwise have been idle.

Mason, Maughan S.
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Mitchell, William A.
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Selected papers: Characteristics of engineers in industry, by Lee E. Danielson; Engineers are a part of management, by Dwight J. Goodman; The engineer in industry--a professional employee, by R. E. Williams, Jr.; The engineer as a manager, by Roger B. Charlesworth; Motivating your engineers for greater creativity and productive effort, by Harold Mosher; Management's role in developing an attitude of professionalism in engineers, by Paul J. Patinka; Management should take the initiative, by William E. Keppler.

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Organisation for Economic Co-operation and Development.
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Park, Ford.
Tomorrow's engineer. Science and technology, no. 72, December 1967, pp. 20-34.
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Reynolds, William C.
A model for engineering manpower utilization. Ann Arbor, Michigan, University Microfilms, 1965.
"The thesis advanced in the dissertation is that those processes of engineering manpower utilization to which planning and control are subject are sufficiently methodical and regular so that development of models of engineering manpower usage is both possible and profitable... The model developed is mathematical in nature and is based upon statistical analysis of manpower assignment patterns as found in a sample of recent engineering design jobs processed by an engineering firm."
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Rudd, Ernest.
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"It seems clear that British industry and the country are losing many scientists of high ability because industry is failing to provide them with careers offering responsible and intellectually stimulating work."

Shapero, Albert.
Managing technical and intellectual resources; our new problems require new solutions. Business horizons, vol. 12, no. 2, April 1969, pp. 23-30.
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Steinmetz, Lawrence L.
The research and development manager's dilemma: fact or fiction. Academy of Management journal, vol. 9, no. 2, June 1966, pp. 145-151.

Examines the problems arising from the nature of the R & D program environment, the relationship between the manager and the scientists and the motivation of the scientists and engineers.

Suits, C. Guy.
Suits: speaking of research. New York, John Wiley and Sons, 1965. 466 pp.

Addresses of the founder of the first industrial laboratory in the United States devoted to basic research and its director since 1945.

Selected contents: The manageability of scientific research; Creativity and technological progress; Creative science in an organizational setting; The postgraduate training of physicists.

Whittington, George A.
Technology and management--where we stand today. Advanced management journal, vol. 30, no. 3, July 1965, pp. 79-83.

Condemns modern management for its lack of preparedness for the technology of today and its lack of awareness of the technology of tomorrow. Deplores the treatment of scientists and engineers who have little job security and often find it necessary to desert their fields for other endeavors. Declares R & D too vital to ignore, and finds it self-defeating for management to be confused in dealing with scientists and engineers.

RECRUITMENT AND SELECTION

Baird, Beverly.
Too many engineers go wrong. Engineer, vol. 9, no. 3, May-June 1968, pp. 15-18.
Comments on reasons for engineer turnover and shortage: applicant's insufficient or incorrect knowledge of the job, a false sense of one's value in the job market, a recruiter's limiting hisselection to applicants in the top grade level or rejecting older workers or applicants having disabilities which do not affect their performance.

Baker, William H.
A study of selected characteristics of cooperative engineering students. Journal of cooperative education, vol. 5, no. 2, May 1969, pp. 40-48.
Research on academic achievement and personality characteristics of co-operative engineering students and non-cooperative engineering students at Tennessee Technological University indicates that the co-operative students hada higher grade point average and that their personalities differed in certain aspects from the non-cooperative group of students.

Barlow, Walter G.
Discontent among engineers. Journal of college placement, vol. 25, no. 3, February 1965, pp. 24-25, 72, 74, 76.
Examines results of a study to determine causes and manifestations of discontent of engineers in industry. Finds current methods of selection and placement at least in part responsible. Holds that recruiters of engineers will be more successful if they take into account emotional elements and relate psychological needs and expectations to the jobs offered.

Biedenback, Joseph M.
College achievement and industrial success. Ann Arbor, Mich., University Microfilms, 1965. 104 pp.
Report of an investigation involving 350 top and middle management engineering personnel from seven divisions of a large industrial manufacturing organization. One of the findings was that "High academic achievement in undergraduate training seems to indicate a greater possibility of executive development."
Doctoral dissertation, Michigan State University, 1964. Abstracted in Dissertation Abstracts, vol. 26, no. 3, September 1965, p. 1419.

Bradford, J. K.
The obsolescence of occupation titles. Journal of college placement, vol. 27, no. 4, April-May 1967, pp. 87, 89-90.
Author comments on the changing attitudes toward job classification and the obscuring of the boundaries between the professional and the technical (as in the engineering sciences). He claims that with new scientific areas opening up, management should shift its definitions of occupations and concentrate on individual characteristics needed for work in certain areas.

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Brown, J. Millard.
The personnel man and Ph.D. recruiting. Public personnel review, vol. 28, no. 3, July 1967, pp. 184-186.
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Cassidy, H. W.
Would your resume get you a job? American engineer, vol. 37, no. 7, July 1967, pp. 14-19.
Pointers to the engineer on how to look for a job and suggestions for preparing and using a personal job resume.

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Technical manpower recruitment practices, 1965-1966. New York, 1966. 34 pp.
Data from a survey of 141 organizations. Covers extent and methods of recruiting and relocation costs for professional level technical people. Also reports on types of technical people sought, effectiveness in 1965 of 1964 manpower planning, cost-per-hire estimates and relocation policies for field engineers and sub-professionals, extent to which top management supports recruiting function and impact of Civil Rights Act on recruiting activities.

Goldenson, Daniel R.
Engineering recruitment practices and markets. A study of the allocation of engineers and scientists in a technical manpower information market. Princeton, N. J., Resource Publications, Inc., 1968. 121 pp.
Analyzes the means by which society allocates engineers and scientists among its organizations. Suggests more effective methods of recruitment and a positive program for dealing with current shortages. Tables and charts.

Hollon, W. R.
Adding a personal touch to recruiting engineering talent. Personnel journal, vol. 44, no. 3, March 1965, pp. 142-143.
Tells of the successful use of a film as a recruiting device by Byron Jackson, Inc. The film serves also as a public relations tool for civic and social groups. It might also be prepared so that it could be used by salesmen, and for indoctrination and training of new employees.

Hurst, C. K.
Report on an exercise in the selection of professional personnel: engineers. Canadian public administration, vol. 8, no. 1, March 1965, pp. 59-65.
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Recruitment and Selection (Cont'd)

Linnell, Tom.
Campus recruiting for the consulting firm? Professional engineer, vol. 39, no. 9, September 1969, pp. 23-25.
Recruiting guidelines for the consulting firm that wishes to compete with larger companies in hiring newly graduating engineers.

Macdougall, Neil A.
Trends in recruiting. Canadian personnel and industrial relations journal, vol. 14, no. 1, January-February 1967, pp. 24-26.
Describes the job market for engineers in Canada and indicates trends toward international recruiting and increased promotion from within. Concludes that today's employer must be prepared to compromise in his search for technical personnel due to the shrinking number of them available.

Mardon, Jasper.
Selection and in-house development of systems engineers. Training and development journal, vol. 21, no. 9, September 1967, pp. 87-98.
Considers three areas from which individuals can be selected to be trained as systems engineers. Reports on an in-house training program used at MacMillan Bloedel, Limited. Comments on auxiliary types of training.

Perrucci, Robert, William K. LeBold and Warren E. Howland.
Organizational views on recruitment, employment, and education of engineers in industry and government. Journal of engineering education, vol. 56, no. 10, June 1966, pp. 389-407.
"This is a report on the views of engineering management and personnel management of both industrial and governmental organizations concerning (1) present and future needs for engineering, scientific, and technical personnel; (2) recruitment practices of organizations; (3) policies for professional development of engineers; and (4) educational needs of engineers. The report is based upon responses from (a) 128 ...management representatives, (b) 133 ... personnel representatives in industrial and governmental organizations that were part of the ASEE /American Society for Engineering Education/ Goals of Engineering Education Survey of Engineers in Industry and Government, and (c) representatives of 110 ... industrial members of ASEE."

Pierson, Jack.
Interviewing engineers: how much do they really know? Personnel, vol. 44, no. 2, March-April 1967, pp. 60-63.
Suggests that skill testing be used in the employment interviewing of an engineer. The engineer's solution to a problem relevant to the prospective employer's situation furnishes better evidence of his qualifications for the position than a presentation of his credentials.

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Pierson, Jack.
"What makes you think you're good enough?" Engineer, vol. 10, no. 2, March 1969, pp. 17-20.
An examination of various types of interviews that may be used on the engineer applicant.

Stambler, Irwin.
Finding and keeping scientists and engineers. Management review, vol. 56, no. 5, May 1967, pp. 47-51.
Discusses recruiting practices, salaries, mobility, and regional cost-of-living differences. Condensed from Industrial Research, March 1967.

TRAINING AND DEVELOPMENT

American Society for Engineering Education.
Engineering college research and graduate study. Journal of engineering education, vol. 59, no. 6, February 1969, entire issue.

Gives details of admission requirements, enrollments, degrees, faculty, fields of scholarship and research and financial support. Seeks to convey the "research climate" of each school.

American Society for Engineering Education. Goals Committee.
Goals of engineering education; final report. Journal of engineering education, vol. 58, no. 5, January 1968, pp. 369-446.

Sections on technological requirements of the future, the need for engineers educated at higher levels, and characteristics of engineers with advanced degrees. Diagram indicates the division of engineers between government and private industry to be about the same for different degree levels.

Boulgarides, J. D. and V. C. San Filippo.
How do engineers look at continuing education? Professional engineer, vol. 39, no. 3, March 1969, pp. 32-33, 35, 37.

From findings of a survey of 157 engineers at McDonnell Douglas Aircraft Company, authors draw conclusions as to type of training desired and make recommendations for improving course design and teaching methods.

Broadwell, Martin M.
A new breed: the engineering training director. Management of personnel quarterly, vol. 4, no. 3, Fall 1965, pp. 3-6.

A properly organized and conducted training program can help keep the engineer up-to-date in his field. Author discusses elements of such a program and enumerates several rules which should apply to it.

Broadwell, Martin M.
A rising star: the technical training director. Training in business and industry, vol. 4, no. 11, November 1967, pp. 23-25, 39.

Engineering education in industry faces complex problems because of accelerated technical obsolescence. The training director, the engineer and the trainer must work together to resolve questions of curriculum, faculty, budget and objectives.

Broadwell, Martin M.
Successful instructor training in industry. Journal of engineering education, vol. 58, no. 2, October 1967, pp. 132-134.

Southern Bell developed an in-house teacher-training course to produce engineering instructors who were both subject and "learning" oriented. It has been generally successful.

Training and Development (Cont'd)

Carron, Theodore J.
Evaluation of a reading development program for scientists and engineers. Personnel psychology, vol. 18, no. 3, Autumn 1965, pp. 281-294.
An investigation to show the relative effectiveness of machine vs. book-centered training methods. Though all participants, scientists and engineers in an industrial laboratory, showed gains in rate, and comprehension at the completion of training, a follow-up eighteen months later indicated the definite superiority of book-centered training.

Chambers, Carl C.
R & D: future demands upon educational institutions. Wharton quarterly, vol. 2, no. 2, Winter-Spring 1968, pp. 4-6.
The Vice President for Engineering Affairs, University of Pennsylvania, "discusses the university's function in fulfilling manpower requirements of the research and development industry in a talk delivered last fall to the National Security Industrial Association Symposium in Washington, D. C."

College-industry interface. Journal of engineering education, vol. 59, no. 9, May 1969, pp. 1017-1063.
Selected contents: Industry-education interaction: synergistic symbiosis, by Thomas L. Martin, Jr.; Engineering education: the interdependent roles of university and industry, by H. A. Mosher and A. K. Ackoff; What an engineer learns in industry, by Charles T. Morrow; The engineering professor as a consultant, by Donald L. Katz; A community effort in continuing education for the development of engineers, by John L. Moriarty, Vernon E. Keller, and Walter L. Dray; A continuing engineering education program for the computer industry, by Eugene F. Brady; and In-plant graduate courses on videotape, by Lionel V. Baldwin.

Constas, Perry A.
Engineering education and the engineer's self-image. Personnel journal, vol. 45, no. 3, March 1966, pp. 153-158.
Identifies forces which influence the self-image of the engineer and the needs that motivate him. Discusses interaction between the engineer and his work environment and the role of education and development programs.

Delate, Joseph L., Jr.
The civil technology program: a system of employee education and vertical job enlargement. Public personnel review, vol. 29, no. 1, January 1968, pp. 37-41.
Describes a program established by the New Jersey Department of Transportation to cope with the shortage in professional and subprofessional civil engineering manpower.

Engineers Joint Council.
Assessment of the goals of engineering education in the United States. Report of the Panel on Engineering Education. New York, 1966. 20 pp.
The Panel reviewed the Preliminary Report on Educational Goals of the American Society for Engineering Education and addressed itself primarily to broad issues and problem areas of fundamental importance to the teaching and practice of engineering. Final recommendation relates to continuing education for engineers.

Training and Development (Cont'd)

How one firm keeps its engineers up to date. Business management, vol. 31, no. 1, October 1966, pp. 107-110.
Describes program of Markem Machine Company of Keene, New Hampshire, for keeping its engineers up to date by importing faculty of an engineering school twice a week. Tells of establishing the program, its problems and future plans for it.

Jones, O. E. and D. L. Hughes.
Unified science and engineering: an in-house continuing education course. Journal of engineering education, vol. 57, no. 8, April 1967, pp. 558-560.
Describes development and content of a course given to engineering supervisors at Sandia Laboratory, Albuquerque, New Mexico to keep them abreast of current scientific developments.

Kimmel, Frank E.
Engineering managership. Manage, vol. 19, no. 5, March 1967, pp. 11-19.
Focuses on the problems of managing engineering personnel, especially combating technical obsolescence, and suggests a program of continuous training.

Kincaid, John F.
Engineering education for an age of change. Personnel administration, vol. 31, no. 5, September-October 1968, pp. 4-7, 14-15.
Article answers "yes" to the question "Can engineering schools produce properly trained and motivated graduates?" Cites problems facing the engineer, such as the information explosion and job obsolescence, and indicates steps to be taken by schools--improved curricula, interdisciplinary study of science and engineering, new programs for post-graduate training (as at M.I.T.'s Center for Advanced Engineering Training), and finally, urges greater cooperation between government, industry, and the university.

Lubetkin, Maurice.
The TD and the doctor--helping the scientist and engineer make better presentations. Training and development journal, vol. 21, no. 6, June 1967, pp. 44-46.
Lists considerations for the training director who is helping an individual with report presentation techniques.

Margulies, Newton and Anthony P. Raia.
Scientists, engineers, and technological obsolescence. California management review, vol. 10, no. 2, Winter 1967, pp. 43-48.
Authors surveyed 290 scientists and engineers engaged in research and development activities to determine how the respondents keep abreast in their fields, which experiences contribute most to professional growth and "ways in which formal educational programs relate to the process of 'revitalization' in the organization."

Miller, Howard M.
Career development of engineers in industry. Journal of engineering education, vol. 59, no. 10, June 1969, pp. 1113-1116.
Considers the role in engineer career development of management, the engineer, education, and industry.

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Monsees, Melford E.
How's your young engineer leadership? American engineer, vol. 37, no. 11, November 1967, pp. 26-27, 29-30, 32.
Pointers on how to guide the young engineer and help him develop.

National Academy of Engineering.
What should the National Academy of Engineering do about engineering education; a symposium, New York City, October 13, 1966. New York, 1967. 151 pp.
Review of current status and goals of engineering education, what the professional societies, the National Academy of Sciences, the government, the National Science Foundation, and industry are doing about it, and what, if anything, the National Academy of Engineering should do.

National Industrial Conference Board, Inc.
Combating knowledge obsolescence; I. Company fellowship plans, by J. Roger O'Meara. New York, 1968. 122 pp. (Studies in personnel policy, no. 209)
An analysis of 75 fellowship plans sponsored by 60 American and Canadian firms. Discusses plan objectives, provisions, and administration. Reveals what the sponsoring companies think of the plan results and how university administrators feel about company-sponsored fellowships.

Payton, Philip W.
A personnel development program for engineers. Personnel journal, vol. 45, no. 2, February 1966, pp. 76-81.
Traces stages of professional development that the engineer goes through, and stresses the necessity for continuation of technical studies as well as cultivation of managerial talent. Points out the responsibility of the supervisor and the personnel department, as well as of the young engineer himself, for growth patterns and continuing education.

Raines, I. I. and J. C. Missar.
Engineering obsolescence: a challenge to the training director. Training directors journal, vol. 19, no. 1, January 1965, pp. 35-42.
Among challenges are those of selling program to management, furnishing professional atmosphere, motivation, and providing for engineers' continuing needs.

Reilly, Donald F.
Upgrading employee skills in Massachusetts. Public personnel review, vol. 28, no. 3, July 1967, pp. 182-183.
An account of the employee training program for both technicians and civil engineers set up by the Massachusetts Bureau of Personnel and Standardization to help alleviate personnel shortages.

Ristau, Robert G.
Education at long distance...PPG's "graduate hotline." Personnel, vol. 42, no. 6, November-December 1965, pp. 45-50.
How one company tackled the problem of keeping the specialized knowledge of scientific and technical personnel up to date.

Training and Development (Cont'd)

Ritterbush, Philip C.
Research training in governmental laboratories in the United States. Minerva, vol. 4, no. 2, Winter 1966, pp. 186-201.
Reviews early efforts to bring graduate students to governmental research centers. Explores four institutional patterns which government sponsored laboratories could follow to ease the strain of increased graduate enrollments.

Sawyer, Herbert A.
Integration and the citizen-engineer. Engineer, vol. 10, no. 5, September-October 1969, pp. 12-14.
Recommends a continuous curriculum for the engineering student, i.e., continuing study in all basic areas through every year or term. Such a system would strengthen liberal arts components and still provide benefits to technical areas. Points out other advantages.

U. S. National Science Foundation.
Continuing education for R & D careers; an exploratory study of employer-sponsored and self-teaching models of continuing education in large industrial and Federal government owned R & D laboratories. Prepared by the Social Research, Inc. Washington, U. S. Govt. Print. Off., 1969. 215 pp. (NSF 69-20)

U. S. Office of Education.
Technical training in the United States, by Lynn A. Emerson. Appendix I, Education for a changing world of work. Report of the Panel of Consultants on Vocational Education. Washington, U. S. Govt. Print. Off., 1963. 170 pp. (OE-80022)
Discusses technical education of semi-professional level from standpoint of technical occupations in industry, training programs, needs, and projected requirements. Includes suggestions for dealing with these needs.

Weir, John R.
Sensitivity training in the classroom. Human relations training news, vol. 12, no. 1, 1968, pp. 5-6.
After describing three T-group courses for undergraduates in engineering and science taught at California Institute of Technology, the instructor states his conviction that T-group methods can make an important contribution to higher education and should be considered whenever possible. Notes that "peaks of intense emotionality and the sudden brilliant flashes of insight are more frequent in the residential setting, while the behavioral changes and the skill in using the insights for continued personal growth seem greater in the year-long course."

Training and Development (Cont'd)

Wheeler, Edward A.
Education for anti-obsolescence? Training and development journal, vol. 22, no. 6, June 1968, pp. 21-26.

Survey of 100 large manufacturing companies regarding their continuing education programs and methods of assessing anti-obsolescence revealed: (1) there was little management evaluation of such programs; (2) less time than recommended was spent by scientists in training; (3) limited recognition of shared responsibility for effectively combating obsolescence existed.

Wheeler, Edward A.
Industrial sponsorship of continuing education for anti-obsolescence of engineers and scientists. Ann Arbor, Michigan, University Microfilms, Inc., 1965.

"Findings of this study inferred that the allocation of man-hours did not comply with that recommended for the combating of obsolescence...." Most obsolescents were senior engineers and scientists and industrially-sponsored technical courses for these personnel were limited.

Doctoral dissertation, Lehigh University, 1965. Abstracted in Dissertation Abstracts, vol. 26, no. 5, November 1965, p. 2573.

Zelikoff, Steven B.
The obsolescing engineer. Science and technology, no. 88, April 1969, pp. 46-51.

Discusses the phenomena that is occurring in the engineering profession whereby a "young adult enters college at 18, graduates with an engineering degree at 23 and may be/considered/ middle-aged (vocationally) at 28." Based on the study of the engineering curricula of five schools, the author concludes that some method must be discovered whereby the technical competence of our engineers is prolonged in order to keep pace with the revolution in technology.

Zelikoff, Steven B.
On the obsolescence and retraining of engineering personnel; a quantification of the problem and some recommendations. Training and development journal, vol. 23, no. 5, May 1969, pp. 3-14.

The engineering curricula for five engineering institutions was examined at five year intervals from 1935 to 1965 in an effort to quantify the problem of obsolescence. Notice was taken of courses added to or dropped from the curriculums and erosion curves were plotted showing the possible loss of applicable knowledge. After establishing the pressing need for updating the engineer's competence, recommends steps different segments of society might take to promote technical excellence.

PAY PRACTICES

Alden, John D.
Engineers' pay checks. New York, Conover-Mast Publications, 1967.
Reveals a 14-year steady increase in salaries of engineers. Provides advice for interpreting statistics and predicts a continuing upward thrust in engineer pay. Chart compares median annual engineer salaries with those of other professions.

American Chemical Society.
Chemists' salaries set record gains in 1966-68 period, by David A. H. Roethel, Office of Professional Relations. Washington, 1968. 7 pp.
Reprinted from: Chemical and engineering news, vol. 46, Oct. 21, 1968, pp. 60-66.
Discusses trends and gives statistics on chemists' salaries, the effect of experience on salary increases, ranges of salaries by geographical area and types of work. Also gives statistics on salaries by sex and academic degree held.

American Chemical Society.
1968 starting salaries, by David A. H. Roethel, Office of Professional Relations. Washington, 1968. 6 pp.
Reprinted from: Chemical and engineering news, November 18, 1968, pp. 76-81.
Gives information on salaries in relation to degree earned, field of study, industry, and geographical location of job. Reveals that in 1968 salaries rose at about the same rate as in 1967.

Are you really underpaid? Engineer, vol. 10, no. 3, May-June 1969, pp. 14-16, 19-20.
A study with many charts and tables demonstrates the upward trends in engineers' salaries and indicates that "today's engineer is materially better off than he or his counterpart was sixteen years ago."

Association of Scientists and Professional Engineering Personnel.
Salary survey, 1968. Camden, N. J., 1968. 8 pp.
Surveys 1189 non-supervisory engineers in the product divisions of RCA at Camden and Moorestown, New Jersey.

Atchison, Thomas and Wendell French.
Pay systems for scientists and engineers. Industrial relations, vol. 7, no. 1, October 1967, pp. 44-56.
Compares three methods of establishing pay differentials: classification, maturity curves, and span of discretion. Compares them also with two measures of perceived equity. The study was carried out in five government installations which employ large numbers of scientists and engineers.

Pay Practices (Cont'd)

Battelle Memorial Institute.
1968 national survey of compensation paid scientists and engineers engaged in research and development. Prepared by Columbus Laboratories. Washington, U. S. Govt. Print. Off., 1969. 1 v.
Survey of 152 establishments--industrial organizations, nonprofit research institutes, contract research centers, Federal government laboratories, and educational institutions. Survey used the "age-wage" approach, relating salary data to years since receipt of degree or chronological age. Prepared for Atomic Energy Commission.

Bright, Jay B.
A new approach to classification of research personnel in the public service of Canada. Professional public service, vol. 44, no. 3, March 1965, pp. 4-5, 8.
Description of the Canadian Civil Service Commission's scheme to classify research personnel into relatively fewer broad classes. Two new classes as far as possible will bring research scientists under a single set of regulations governing recruitment, pay, and appraisals for promotions. Tells who will qualify as a research scientist, points out distinguishing characteristics of the new classes, and comments on the over-all reaction to the plan.

Chalupsky, Albert B.
Incentive practices as viewed by scientists and managers of pharmaceutical laboratories. Personnel psychology, vol. 17, no. 4, Winter 1964, pp. 385-401.
Because of interest in management problems related to administration of professional personnel,this study was undertaken to investigate types of incentives now used for scientific employees. A depth survey considered extent of agreement between managers and laboratory scientists on effectiveness of incentives, and agreement of scientists of varying ages and productivity. Results indicate attitudes of the groups on merit salary increases, tuition aid, promotion, attendance at professional meetings, and encouragement to publish.

Dinsmore, William F.
The case for evaluating professional jobs. Personnel, vol. 41, no. 6, November-December 1964, pp. 54-60.
Explains why "... a sophisticated job-evaluation scale can be applied equally well to professional and R and D jobs."

Douglass, William A.
About engineering salaries. American engineer, vol. 37, no. 4, April 1967, pp. 40-46.
An engineering placement executive discusses factors affecting engineering compensation.

Engineering Manpower Commission.
Engineering salaries; special industry report. Analysis by region and company size, 1966. New York, 1967. 64 pp.
"This report is based on the ... biennial survey of engineers' salaries, but for purposes of more thorough analysis by industry the data have been broken down in greater detail by degree and supervisory status."

Pay Practices (Cont'd)

Engineering Manpower Commission.
Professional income of engineers, 1968-1969. New York, 1969. 96 pp.
Survey of salaries of engineering graduates indicating trends over the last fifteen years. Tables and charts for industry groups, for Federal, state and local governments, and by region. Provides data for supervisory and non-supervisory personnel.

Engineering Manpower Commission.
Salaries of engineering technicians. New York, 1966. 62 pp.
First survey of technicians. Presents salaries as a function of years of experience. Shows medians, quartiles, and deciles for each industry group.

Filley, A. C.
An annotated bibliography of studies on the motivation and payment of professional personnel. Journal of the College and University Personnel Association, vol. 20, no. 2, February 1969, pp. 13-24.
Emphasis is on scientists and engineers.

Frey, Carl.
Engineers' salaries. International science and technology, no. 38, February 1965, pp. 32-37.
An analysis of engineers' salaries from 1953 to 1964 shows: salaries continuing to rise, but more moderately than in early fifties; experienced teachers catching up in earnings with engineers in industry, or earning more with supplemental income; and those with advanced degrees earning several thousand more than those without them.

Gross, Andrew C.
Patterns and determinants of income of Canadian engineering graduates. Industrial and labor relations review, vol. 23, no. 1, October 1969, pp. 52-64.
Presents data on current income of those holding electrical engineering degrees from Canadian universities and traces growth of these earnings. Examines impact of independent variables on income and the relationship of mobility to salary. Compares income of Canadian engineers with that of other Canadians and with engineers in the United States.

Heiss, F. William.
Upgrading an engineering division. Public personnel review, vol. 27, no. 3, July 1966, pp. 166-169.
A deficiency of promotable engineers triggered the development of a three-phase program to provide incentives and allow for diversified experiences.
The classification and pay plan was revised to distinguish between engineers who had obtained professional registration, and between engineers, with experience and no college degree and the engineer with a college degree and/or professional registration. New plan added a fourth level of engineering aide (engineering technician) and a fifth level of civil engineer.

Pay Practices (Cont'd)

Hurst, D'Orsey.
Can your consulting firm's salary program attract and hold creative young engineers? American engineer, vol. 38, no. 6, June 1968, pp. 50-53.
Many consulting firms find it difficult to compete with industry and government for young engineer graduates. Reviews factors that aid in attracting and retaining engineers and presents a point system to motivate personnel, give them a sense of participation, and encourage and reward new business development activities and certain professional ones.

Lee, Sang M.
Salary administration practices for engineers. Personnel journal, vol. 48, no. 1, January 1969, pp. 31-38.
An analysis of findings of a survey of engineer salary administration policies and practices of 120 companies in various industries. Results indicate that compensation is a function of many environmental, organizational, and personal factors which are seldom combined and applied in a systematic fashion.

McLoughlin, William G.
The case for research accountability. New York, American Management Association, Inc., 1967. 23 pp. (Management bulletin 98)
Section on organization of research (pp. 8-13, app. A) urges avoidance of a rigid organizational structure in favor of a position classification scheme relating education and experience to position and grade level.

National Society of Professional Engineers.
Professional engineers' income and salary survey, 1967. Washington, 1968. 57 pp. (Publication no. 0004)

National Society of Professional Engineers.
State government engineering salary scales. A survey report prepared and published by the Professional Engineers in Government. Washington, 1966. 51 pp. (NSPE publication no. 1309)

Patten, Thomas H., Jr.
Maturity-pay curves in a floating labor market: the case of Southern California. Quarterly review of economics and business, vol. 7, no. 3, Autumn 1967, pp. 57-72.
An analysis of a distinctive job-evaluation and salary administration plan for paying scientists and engineers in the highly mobile labor force area of Southern California. The plan utilizes the maturity-pay curve, which shows salaries plotted against age or experience. Sample curves are shown.

Pay Practices (Cont'd)

Peters, Ralph W., Jr.
A new approach to engineer salaries. American engineer, vol. 37, no. 8, August 1967, pp. 31-32, 34-35.
Describes a salary classification system which focuses on assignment complexity. This system is designed to reward the technical investigator equally with the managerial or administrative engineer and also to provide maximum challenge and opportunity for individual development.

Pierson, Jack.
What's a young engineer worth? American engineer, vol. 38, no. 6, June 1968, pp. 57-59.
A discussion of the engineer shortage and the problem of establishing a salary schedule.

Roden, A. E.
Increased motivation through engineering salaries. Personnel journal, vol. 44, no. 1, January 1965, pp. 38-40.
Explains a bonus system of compensating engineers to reward them for periods of high performance.

Rodney, Thomas C.
Do R & D positions call for separate evaluation plans? Personnel, vol. 42, no. 3, May-June 1965, pp. 37-43.
Survey responses of forty-seven aerospace companies indicate that seventy-eight per cent evaluate R & D positions. Most of the evaluation plans are modeled on the original National Metal Trades Association and National Electrical Manufacturers Association plans, neither of which is pertinent to-day. The development of separate plans to evaluate R & D positions might well provide a useful topic for wage and salary administrators at this time.

Roethel, David A.
Salaries increase 7.6% this year. Chemical and engineering news, vol. 47, no. 26, June 23, 1969, pp. 92-98.
Chemists' salaries gains are on a par with wage rise of 7% for all categories of workers this year. Among factors influencing salary are academic degree, type of employer, field of specialization, and geographical location. The Federal government seems to have achieved some salary parity with industry.

Salaries and selected characteristics of U. S. scientists, 1968.
Reviews of data science resources, no. 16, December 1968, 8 pp.
A preliminary report based on the 1968 National Register of Scientific and Technical Personnel.

Pay Practices (Cont'd)

Scientific Manpower Commission.
Salaries of scientists, engineers, and technicians; a summary of salary surveys. Washington, 1969, 96 pp.
Contains starting salaries, salaries of experienced scientific and engineering personnel, engineering salaries, women's salaries, Federal government salaries, academic salaries, supply and demand, and bibliography of sources.

Snyder, Omar.
Employee classification in a research laboratory--the Stanford Linear Accelerator Center Plan. Journal of the College and University Personnel Association, vol. 17, no. 3, May 1966, pp. 1-13.

U. S. Bureau of Labor Statistics.
National survey of professional, administrative, technical, and clerical pay, June 1968. Washington, U. S. Govt. Print. Off., 1969. 80 pp. (Bulletin no. 1617)
Chemists and engineers were surveyed in eight levels. Gives average salaries in metropolitan areas, large establishments, differences by industry, and employment distribution by salary.

Van Steenburgh, W. E.
Appraisal of professional scientific personnel. Professional public service (Canada), vol. 44, no. 1, January 1965, pp. 12-13.
Describes the activity of the Scientist Appraisal Committee, Canada, Department of Mines and Technical Surveys in reclassification and in improved ways of applying the merit system to scientists.

Wright, Douglas G.
Light reins on the research boys. Personnel management and methods (Gt. Brit.), vol. 31, no. 294, January 1965, pp. 22-24, 29.
Suggests a philosophy to underlie the determination of staff grades in a research association. Indicates how the grade scheme and the promotional pattern fit into the whole grading concept. Offers a salary schedule.

EVALUATING THE PERFORMANCE OF SCIENTISTS AND ENGINEERS

Britton, John P.
The productivity of scientists: a prelude to manpower studies. Springfield, Va., Clearinghouse for Federal Scientific and Technical Information, 1965. 25 pp. (PB 167 470)

"Previous studies have yielded distributions of productions among scientists which are shown to be incomplete versions of a general complete production distribution. The correction for completeness is found to affect the high producers most markedly and preserves the large proportion of low producers found in earlier studies...."

Cline, Victor B., Michael F. Tucker, and Stanley A. Mulaik.
Predicting factored criteria of performance measures of pharmaceutical scientists. Journal of industrial psychology, vol. 4, no. 1, 1966, pp. 7-15.

"One hundred and fifty-seven pharmaceutical scientists were rated as to their creativity, skill with people, quality of work produced and overall work performance by supervisors, peers and subordinates. These ratings were subjected to a semantic factor analysis to obtain distinct 'meaning' dimensions. Using a double cross validation design and items from a Biographical Inventory...keys were constructed to predict these 'meaning' dimensions derived from the preceding factor analysis."

Harrold, Raymond W.
An evaluation of measurable characteristics within Army laboratories. IEEE transactions on engineering management, vol. EM-16, no. 1, February 1969, pp. 16-23.

"The problem of this study was to develop information that might help management of a laboratory complex." Among the 15 measurable characteristics evaluated were R and D experience, civilian salary, age and in-house R and D obligations. The two standards used in the evaluation were (1) laboratory performance and (2) the number of papers and invention disclosures. The first was found to be more possible to predict than the second.

Kirchner, Wayne K.
Relationships between supervisory and subordinate ratings for technical personnel. Journal of industrial psychology, vol. 3, no. 3, 1965, pp. 57-60.

Report of an investigation in which the ratings of their own job performance by 92 technical hires was compared with similar supervisory ratings of their performance. Findings indicated marked differences between the ratings.

Evaluating the Performance of Scientists and Engineers (Cont'd)

Knutila, Chester.
A tool for evaluating performance of R & D engineers. Management services, vol. 3, no. 3, May-June 1966, pp. 36-40.
Suggests a Project Engineer Evaluation Report (PEER) as a means of assuring that the best engineers are assigned to the most critical projects. The rating system stresses the ability to complete the project within the time and money limits imposed by management rather than merely a technical grasp of the problems. Sample reporting form included.

Lipetz, Ben-Ami.
The measurement of efficiency of scientific research. Carlisle, Mass., Intermedia, Inc., 1965. 262 pp.
Clarifies the meaning of efficiency as applied to scientific research activity and indicates specific approaches by which efficiency measurements may be applied to scientific research to improve productivity. Bibliography.

Seidman, Dennis.
A study of criteria of quality performance among Air Force scientists and engineers. Washington, U. S. Department of the Air Force,n. d. 16 pp.
Examines Dr. William Shockley's "Merit Index" which evaluates scientists' and engineers' accomplishments and prospects for future growth by comparing their salaries with those of persons of the same age doing similar work. Concludes that valid appraisals are possible only by trained personnel using a carefully planned appraisal program.

Steinmetz, Lawrence L.
The problem engineer: cause, identification and cure. American engineer, vol. 38, no. 1, January 1968, pp. 48-54.
Advises use of management by objectives to pinpoint problem performers, and describes 12 such types of engineers. Ends with suggestions for combating marginal performance.

Taylor, Calvin W. and Kan Yagi.
Results for an additional follow-up criterion on a sample of Air Force scientists. Alexandria, Va., Defense Documentation Center, 1966. 13 pp.
Report supplements an earlier study. It relates to an additional over-all criterion, a 6-man committee rating of the scientist. Likeableness as a member of a research team was found to be the most significant criterion dimension with respect to the over-all criterion.

U. S. Department of Agriculture.
The use of quality and quantity of publication as criteria for evaluating scientists, by Byron T. Shaw. Washington, U. S. Govt. Print. Off., 1966. 78 pp. (Miscellaneous publication no. 1041)
Publications of 3000 scientists in the Agricultural Research Service were tabulated to find a possible relationship between publication output and the grade, degree, position title, length of experience, and work location of their authors. This study also includes the ARS plan for the evaluation of these publications to determine promotion and placement.

SELECTING AND DEVELOPING TECHNICAL PERSONNEL FOR MANAGEMENT RESPONSIBILITIES

Bailey, Robert E. and Barry T. Jensen.
The troublesome transition from scientist to manager. Personnel, vol. 42, no. 5, September-October 1965, pp. 49-55.
" ... higher management must show a greater awareness of the special problems the technical man faces in starting up the managerial ladder and must actively help him to overcome them."

Barkley, Bruce T.
The program management officer in the public service: his role in policy formulation and administration. Public administration review, vol. 27, no. 1, March 1967, pp. 25-30.
The program management officer in the Public Health Service combines line and staff functions as a scientist concerned with the administration of scientific programs. The author notes variations in his roles and functions and lists basic qualities needed in the position.

Bolster, Mel H.
Extending managerial competence; planning the transition from scientist to manager in the Federal government. Washington, National Institutes of Health, 1966. 44 pp.
Differentiates between R & D management and other kinds of management and cites specific qualities needed by these managers. Research to define the problems encountered in the transition to management is suggested in order to develop new approaches to training the scientist-manager.

Carlin, Thomas W.
Prepare ahead for those executive decisions. American engineer, vol. 37, no. 10, October 1967, pp. 18, 23-25.
Points out to the engineer the need for management training if he is to move ahead in the corporate area.

Chironis, Nicholas P.
Management guide for engineers and technical administrators. New York, McGraw-Hill, 1969. 376 pp. Id22 .C44m
Addressed not only to engineers and their managers but also to plant administrators, production supervisors, designers, draftsmen and researchers. Contains information on how and when to develop new products, ways of estimating costs, methods of speeding up drafting and reproducing operations, procedures for releasing and controlling drawings. Chapters also cover creativity, inventiveness, and patent law; market research; and the use of consultants and outside services. Scattered throughout are valuable tables, charts and check lists.

Churchman, C. West, C. E. Kruytbosch, and P. Ratoosh.
The role of the research administrator. Berkeley, University of California, Space Sciences Laboratory, 1965. 11 pp. (Internal working paper no. 38)
A preliminary attempt to characterize a number of role orientations among research administrators by means of a series of self-administered rankings of the functions they perform.

Selecting and Developing Technical Personnel for Management Responsibilities (Cont'd)

Cochran, S. W. and D. K. Chinlund.
What edge does formal management training give engineering managers? Professional engineer, vol. 39, no. 5, May 1969, pp. 43-45.
Two industry executives state that in order for an engineering manager to be effective and successful in today's complex business environment, he must have a sound formal business education. They conclude that the engineering manager may no longer focus all his attention on the project he is directing, but must integrate the firm's engineering function with its human activity and management policies.

Conference on the Administration of Research, 19th, University of California, Los Angeles, 1965.
Proceedings. Denver, University of Denver, Denver Research Institute, 1965. 140 pp.
Section on "Research management as a profession" includes: The knowledge base for education of research managers, by Donald G. Marquis; UCLA programs of continuing education for the modern executive, by Russell R. O'Neill; The management technology gap and executive education, by Joseph D. Carrabino.

Confrey, Eugene A.
Science administration: NIH training for a young profession. Civil service journal, vol. 9, no. 1, July-September 1968, pp. 8-11.
A picture of the Grants Associates Program for science administrators at the National Institutes of Health: organization and management, placement of graduates, evaluation.

Cottingham, Edward L.
Management development for junior civil engineer corps officers in public works activities. Alexandria, Va., Defense Documentation Center, 1963. 85 pp.
Submitted in fulfillment of the requirements for the course, Individual Research MN-400, U. S. Naval Postgraduate School, Monterey, California.

Dean, Burton V.
Evaluating, selecting, and controlling R & D projects. New York, American Management Association, 1968. 127 pp. (AMA research study 89)
Research based on questionnaires from company interviews, an analysis of published literature and the results of a seminar. Includes coverage of the role of the R & D manager, the impact of R & D projects on performance, and idea generating and handling.

Denault, Milton F.
Developing the engineer as a manager using computerized simulation. Training and development journal, vol. 21, no. 9, September 1967, pp. 83-84, 86+.
Describes the Goddard Research and Engineering Management Exercise (GREMEX), a game used to provide experience in R & D project decision-making from the management point of view.

Selecting and Developing Technical Personnel for Management Responsibilities (Cont'd)

deRosa, L. A.
Technical competence cannot be replaced by formal management training. Professional engineer, vol. 39, no. 6, June 1969, pp. 34-37.
Argues that formal management education can not replace the technical competence to-day's engineer-manager needs for decision making.

Dougherty, John J.
The engineer among people. American engineer, vol. 36, no. 7, July 1966, pp. 37-41.
"... the range of personalities within the engineering profession seems to cover as wide a spectrum as any other profession." However,there are some whose interest is more task than people oriented. This may bring problems when they must work with others or take on supervisory responsibilities. Author points out a trail the engineer will usually follow when he realizes his understanding of people versus technology is out of balance.

Dougherty, John J.
Joel Nordica turns administrator: a case history. Professional engineer, vol. 38, no. 10, October 1968, pp. 46-50.
Case study of a fictional engineer turned administrator and some of the human relations problems involved. Poor communications and resistance from "pre-behavioral science" engineer-managers created insoluble problems for a new and creative employee.

The engineer and management. Journal of engineering education, vol. 59, no. 8, April 1969, pp. 945ff., 949 ff., 953ff., 957ff., 960ff., and 967 ff.
Six articles on the engineer and management: Engineering characterology and management careers, by Charles E. Goshen; Undergraduate engineering as preparation for management, by Herbert E. Smith; Experiments with T groups in manager education for engineers, by Oron South; Economics and engineering management, by J. Morley English; An engineering management development program, by Joseph B. Smith, Jr., and Management programs in engineering colleges.

The engineer as a chief R & D executive. Engineering manpower bulletin, no. 12, January 1969. 4 pp.
An analysis of data on engineers as chief R & D executives drawn from a survey conducted by the management consulting firm of Heidrick and Struggles. Some implications are that small companies are more likely to have engineers than non-engineers in top R & D slots, engineers are more mobile, they are younger and are less likely to have advanced degrees, and have different compensation patterns.

Selecting and Developing Technical Personnel for Management Responsibilities (Cont'd)

Executive Study Conference, Cleveland, Ohio, April 20 and 21, 1965.
Research and technical personnel in management; selection, motivation, development. Proceedings .... Princeton, N. J., Educational Testing Service, 1968. 140 pp.

Partial contents: Personal attributes of technical personnel: implications for development; Early identification of technical managerial potential; Characteristics of young engineer managers; Goals of engineers, scientists, and engineering managers; Developing potential managers in technical and research areas: the theoretical and the practical aspects; Factors influencing and changing aspirations of technical personnel; Problems of providing motivation in technical areas; Developing the technical manager: group learning and technical updating; Profiting from interpersonal laboratory training; The university and technical obsolescence.

Fellows, John E.
The professional employee as manager. Advanced management journal, vol. 33, no. 1, January 1968, pp. 47-55.

Discusses issues relating to the professional employee as manager in the R & D laboratory. Suggests that in selecting employees for promotion, the entrepreneurial manager consider not only the intelligence and competence of the candidates, but their emotional-prejudicial complex and culturally-imposed inhibitors as well.

Fleming, Michael E.
The importance of technical education in research and development management. Advanced management journal, vol. 30, no. 2, April 1965, pp. 44-49.

Answers the query of whether research and development should be administered by a technical expert or one versed in management by suggesting a look at both the job and the man. At the upper levels of management no technical training may be required.

Frank, Julian S.
A short course in psychology for engineer-managers. Training and development journal, vol. 22, no. 10, October 1968, pp. 8-16.

A survey of 265 electrical engineers showed the inappropriateness of their training and personality structures for transfer to managerial responsibilities. Author cites their preferences for leadership style and their attitudes toward Theories X and Y as applied to themselves, plant foremen, and plant workers. He then proceeds to make several recommendations for training in human relations and managerial skills.

Glennon, J. R., W. D. Buel and Lewis E. Albright.
Making the best use of R & D manpower. Business horizons, vol. 11, no. 2, April 1968, pp. 63-68.

The problem of determining which researchers have managerial potential and which would do better in research only is discussed and a solution based on recent research findings is proposed.

Selecting and Developing Technical Personnel for Management Responsibilities (Cont'd)

Goodman, Richard A.
Ambiguous authority definition in project management. Academy of Management journal, vol. 10, no. 4, December 1967, pp. 395-407.
Reports a study of 50 different projects in 50 different firms which revealed that authorities assigned to the project manager are unrelated to organizational structure within the firm. Author discusses the dual authority problem in project management in R & D organizations. He considers adaptations to it, its origin, benefits and drawbacks.

Hawbacon, C.
The lion and the unicorn or twaddle about technologists. Personnel magazine (Gt. Brit.), vol. 31, no. 305, December 1965, pp. 24-25.
Casts doubts on the technologist's qualifications for management. Feels that he is more oriented to masses of facts than to value judgments.

Hay, John E.
The relationship of certain personality variables to managerial level and job performance among engineering managers. Ann Arbor, Michigan, University Microfilms, 1964. 97 pp.
Study aims "to investigate and clarify the relationship between measures of personality, supervisory style, values and self-ideal congruence to rated performance and position level in the management hierarchy." It used sixty-two engineering managers in the manufacturing department of a large petroleum company. Among the findings was the fact that "there exist opportunities for persons with diverse personalities at all management levels; no one type of personality predominates at a given level."
Doctoral dissertation, Temple University, 1964. Abstracted in Dissertation Abstracts, January 1965, vol. 25, no. 7, p. 3973.

Heidrick and Struggles, Inc.
Profile of a chief research and development executive. Chicago, 1968. 11 pp.
A survey of chief research and development executives in 232 large industrial firms. Includes data on age, education, experience, route to present position, outside activities, salary, most logical promotion, and outside experience for successor.

Hibsman, D. E.
Why do engineers want MBA's? Personnel administration, vol. 31, no. 1, January-February 1968, pp. 52-55.
Presents findings from an investigation to determine reasons for the trend among engineers of choosing MBA degrees in preference to MS degrees for advancing their careers.

Hurt, Rex.
How to make a manager out of an engineer. In Society for Advancement of Management. Research and development management. New York, 1966, pp. 13-21.
In an address before the Chicago Chapter of the American Society of Mechanical Engineers, Mr. Hurt outlines the techniques that can help a man trained in engineering properly execute management functions. Among these are getting experience in training in human relations, and keeping alert to new ideas and methods of management.

Selecting and Developing Technical Personnel for Management Responsibilities (Cont'd)

Karger, Delmar W. and Robert G. Murdick.
New challenges and responsibilities for technical managers. Advanced management journal, vol. 33, no. 2, April 1968, pp. 75-82.
Explores areas where technical managers face new challenges such as human resources, physical facilities, organizational complexities, decision making, long-range planning, automation. Recommends advanced training and education for those who must meet these responsibilities.

Kimmel, Frank E.
Hurdles on the climb to management. American engineer, vol. 37, no. 10, October 1967, pp. 14-17.
Transitions the engineer must make and barriers he must overcome to develop into a successful manager.

Kroeger, Louis.
Technician to manager: a difficult move. Administrative management, vol. 26, no. 7, July 1965, pp. 43-44.
Author feels that it is often too much to expect highly-qualified technicians to be successful in management positions, which demand an understanding and proper direction of people, things, money, and information. However, he considers that, in general, management trends are pointed in the right direction and describes what makes for good management in this age of expansion.

Laski, Joseph S.
An evaluation of the effectiveness within research and development management of persons with non-technical management degrees, based on Air Force officer effectiveness reports. Ann Arbor, Michigan, University Microfilms, Inc. 1965. 185 pp.
Doctoral dissertation, American University, 1965. Abstracted in Dissertation Abstracts, vol. 26, no. 3, September 1965, p. 1758.

McCord, Mac.
How to develop administrative engineers. Swarthmore, Pa., Personnel journal, Inc., 1963. 19 pp.
"Management, particularly executive management, is a profession in itself. ... Dismal futures are prophesied for those engineering organizations where the engineering/physical science degree is a prerequisite for management, and where the 'best engineer' continues to be selected for the open management position."

Morsh, Joseph E., M. Joyce Giorgia and Joseph M. Madden.
A job analysis of a complex utilization field: the R & D management officer. Lackland Air Force Base, Texas, Air Force Systems Command, Personnel Research Laboratory, Aerospace Medical Division, 1965. 60 pp. (PRL-TR-65-1)

Selecting and Developing Technical Personnel for Management Responsibilities (Cont'd)

Niemi, John A.
Executive development from specialist to generalist. Ann Arbor, Mich., University Microfilms, Inc., 1967. 209 pp.

A study of UCLA's Engineering Executive Program established to bridge the gap between engineering and management. In addition to examining the degree to which the program's objectives were being met, two other factors were explored. These were: the effect of participation in the program on managerial mobility and the extent to which program graduates had altered their interests and activities.

Doctoral dissertation, University of California, Los Angeles, 1967. Abstracted in Dissertation Abstracts, vol. 28, no. 2, August 1967, p. 461A.

Overton, Lewis M., Jr.
R and D management: turning scientists into managers. Personnel, vol. 46, no. 3, May-June 1969, pp. 56-63.

Typical R and D supervisory personnel (group leaders) are promoted from purely scientific or engineering slots with little preparation for their new responsibilities. Author suggests some approaches to supervisory development based on the motivational and human relations aspects of the laboratory setting. He proposes training for the supervisors' superiors, the R and D managers, in goal-oriented development; and touts on-the-job training as well as formal training for the supervisor himself. It is recommended that the new group leader should not be asked to supervise his former colleagues.

Roberts, Edward B.
Facts and folklore in research and development management. Industrial management review, vol. 8, no. 2, Spring 1967, pp. 5-19.

Cites fads connected with R & D management and suggests that desirable practices lie in opposite directions from current trends insofar as decision-making, communication, and contracting trends are concerned.

Recommends a new role for graduate schools of management in sponsoring centers for the propagation of management action based on facts rather than folklore.

Rubinstein, Eli A.
The Federal health scientist-administrator: an opportunity for role integration. American psychologist, vol. 23, no. 8, August 1968, pp. 558-564.

Reviews recent studies which explore functions and conflicts of the Federal health scientist-administrator, reasons why scientists become administrators, and the need to achieve a synthesis of the two roles.

Scanlan, Burt K.
Making good managers of good technical men. Training in business and industry, vol. 1, no. 2, November-December 1964, pp. 40-41.

Dr. Scanlan offers advice on the means of identifying potential managerial material in technical men. He outlines and explains a pertinent program of pre-management training, then counsels continued development on the job.

Selecting and Developing Technical Personnel for Management Responsibilities (Cont'd)

Schoner, Bertram and Thomas W. Harrell.
The questionable dual ladder. Personnel, vol. 42, no. 1, January-February 1965, pp. 53-57.

A study of the dual ladder of advancement scheme for both technical and managerial personnel in the same company appears to indicate that high morale among the former does not entirely depend upon their having same status and same pay as their colleagues on the managerial side.

Siepert, Albert F.
The creation of management talent for R & D efforts. Paper presented at the 33rd annual meeting of the Engineers' Council for Professional Development, Clearwater, Florida, October 5, 1965. Gainesville, University of Florida, Florida Engineering and Industrial Experiment Station, 1966. 14 pp.

Presents eleven points which underlie sound administrative actions in research and development and suggests that engineering schools offer a combination package leading to a Master's Degree in Engineering Management.

Reprinted from: Engineering progress at the University of Florida, vol. 20, no. 2, February 1966.

Silverman, Melvin.
The technical program manager's guide to survival. New York, John Wiley and Sons, Inc., 1967. 126 pp.

Manual for the engineer or specialist turned manager. Emphasis is on securing cooperation and authority from all strata of the company. Explains philosophy and management mechanisms, examines problems of financial and personnel controls, and provides definitions of types of management control systems.

Society for Advancement of Management.
Proceedings of the annual conference. The bridge between science and management. New York, 1965. 128 pp.

Partial contents: Effective use of scientific manpower; Care and feeding of scientific personnel; Preparing scientists for management.

Steele, Lowell W.
What's the boss for? International science and technology, no. 43, July 1965, pp. 52-57.

A view of the role of the technical manager as delineated through conversations with scientists and engineers in research and development activities in the General Electric Company.

Steiner, George A. and William G. Ryan.
Managerial methods of successful project managers with a loose rein. Los Angeles, University of California, Graduate School of Business Administration, 1965. 86 pp. (NASA research paper no. 1)

Focuses attention on the loose rein method, analyzes it and sets forth its advantages. Study based on depth interviews with a group of project managers in the research and development phase of the aerospace industry.

Selecting and Developing Technical Personnel for Management Responsibilities (Cont'd)

Turner, Barry.
How do engineers manage? Personnel and training management (Gt. Brit.), November 1968, pp. 20-23.
Describes training needs as well as a training process to ease the transition from scientist to manager.

U. S. Department of Agriculture. Graduate School.
No easy answers; the proceedings of the first management development program for supervisors of scientists and engineers. Washington, 1964. 65 pp.
Two sessions led by Ross Pollock, U. S. Civil Service Commission: Human forces in your organization, and, Motivation and human relations.

Vore, Martin C.
Closing a manage-mentality gap in engineering. Management, vol. 21, no. 6, April 1969, pp. 47-51.
Pointers for technical managers for meeting management problems such as resistance to new equipment, personality differences, training, communications, etc.

Walters, Jack E.
Research management: principles and practice. Washington, Spartan Books, 1965. 367 pp.
"This material is offered ... as a broad philosophy of teaching scientists and engineers to be managers by the combined use of various instructional methods--textbooks, subject literature, cases, lectures, oral and written reports, written examinations, role-playing and management practicing."
Selected contents: Chapter 7, Leadership, creativity and human relations; Chapter 8, Human relations and the motivation of leading; Chapter 11, Coordination and evaluation of research and development. Appendices contain examples of position descriptions and case histories.

Webb, Frank K.
The "manager" gap: problem or opportunity. Advanced management journal, vol. 32, no. 4, October 1967, pp. 62-67.
Maintains that the manager is really an extension of the engineer, since both are basically problem-solvers. Defines the "manageer" as an engineer having managerial talents as well as a solid technical background. Comments on the engineering shortage and identifies qualities to look for in promoting a man to the manageering position: a well-grounded technical background and skill in communications and in motivating people.

Webb, J. S.
Can technical people fill the management gap? Engineering opportunities, vol. 5, no. 3, March 1967, pp. 60, 64, 68.
Discusses the existing management shortage in the electronics industry, suggests that the natural source of managers is the technical staff which has knowledge of the field and can develop a working knowledge of management principles. Lists some attributes of a good manager and qualities of the scientist which will enable him to function effectively as a manager.

PERSONALITY AND PROFESSIONAL CHARACTERISTICS OF SCIENTISTS AND ENGINEERS

Allison, David.
The industrial scientist. International science and technology, no. 62, February 1967, pp. 20-31.

Pictures the tough, complex world of the industrial scientist. Presents a table from a study by Howard Vollmer indicating the attitude of industrial scientists toward their work, with comparable views of their colleagues in the Federal government and universities. Also presents charts from an investigation by Donald Pelz and Frank Andrews showing the performance of laboratory scientists.

Chusid, Frederick.
How to be fired and turn it into a success. Professional engineer, vol. 39, no. 6, June 1969, pp. 23-26.

Since there are many job openings for today's engineer, the one who has been fired should take a planned approach to placing himself in a new position. Self analysis, planning, advice-getting and counseling may be the keys for him to obtain a more satisfying position than the one he left behind.

Dixon, Marlene D.
But are you really a professional? Engineer, vol. 9, no. 1, January-February 1968, pp. 16-19.

Reviews the traditional concept of the profession and shows how changing conditions have affected engineering. Concludes that "the fate of engineering as an occupation depends on whether or not engineers as a group will seize the initiative in enhancing their own professionalism."

Engineer unions: do they help or hurt? American engineer, vol. 37, no. 11, November 1967, pp. 34-38.

Arguments pro and con on engineer unions, presented by a professional engineer and a union official. Contents: Strikes, picketing, organizational goals before professionalism, by W. L. Crowder; Collective bargaining approach for economic security, by Henry J. Adreas.

Engineering Manpower Commission.
Critical interfaces for engineers and scientists; ... four appraisals. Proceedings of the annual joint meeting of the Engineering Manpower Commission of Engineers Joint Council and the Scientific Manpower Commission, New York, N. Y., May 18, 1967. New York, 1967. 27 pp.

Today's technology constantly presents new challenges as well as new obstacles. Each author describes, from his own point of view, an issue facing today's young scientist or engineer with reference to his education, career choices, and job experience.

Engineers Joint Council.
The engineering profession; a new profile. A report from the National Engineers Register. New York, 1969. 8 pp. Ie172 .En3ep

Brief textual comment and charts showing age, years of experience, highest degree, type of employer, employment function and employment area of technology.

Personality and Professional Characteristics of Scientists and Engineers (Cont'd)

Ferdinand, Theodore N.
Personality and career aspirations among young technologists. Human relations, vol. 22, no. 2, April 1969, pp. 121-135.

A group of science and engineering students were examined to establish the relationship between their career choices and their personality and background characteristics. On the basis of questionnaire responses eleven traits were discerned as applying to the professional interests and competences of the students. Depending upon the degree to which the various characteristics applied, each participant was classified as Rationalist, Conventionalist, Pragmatist or Activist. The author suggests that this character typology "provides a useful lever for differentiating patterns of professional behavior and career performance."

Gammell, John.
The engineer--is he obsolete? American engineer, vol. 35, no. 3, March 1965, pp. 51-54, 74-75.

Three chances of becoming obsolete as an engineer: personally failing to keep up with new developments in the field, as data processing; new subject matter changing the content of engineering, as electronics in electrical engineering; new concerns entering the profession, as the aerospace industry. Pleads for the engineer to do his part in developing ways to utilize materials and resources for the benefit of mankind. Article appeared in Mechanical engineering journal, February 1963.

Gilman, William.
Science: U. S. A. New York, Viking Press, 1965. 499 pp.

Chapter 4, "The new elite," gives an inside view of scientists--the laureates, rank and file, administrators, their emoluments, fraternities and spokesmen.

Gilroy, Thomas P.
New developments in the labor movement: how fast are engineers and technicians joining up? Personnel, vol. 46, no. 1, January-February 1969, pp. 50-53.

Quotes figures showing a recent rise in union membership of engineers and technicians. Suggests that the growth in unionization of other professionals may have been a prime influence in this rise. Points out factors that may affect both its acceleration and its deceleration in the future.

Gould, Jay M.
The technical elite. New York, Augustus M. Kelley, Publisher, 1966. 178 pp.

Concerned with the natural scientists and engineers who are more and more responsible for America's industrial productivity. Interprets the growth of this elite "against the setting provided by Veblen's writings, particularly in The Engineers and The Price System, which offers what can be called a theory of a technical elite."

Personality and Professional Characteristics of Scientists and Engineers (Cont'd)

Greenberg, Daniel S.
The myth of the scientific elite. Public interest, no. 1, Fall 1965, pp. 51-62.

Suggests that the scientific community, while having a place at the Federal council tables, does not really exercise very much political power. The primary reason for this, according to Greenberg, is the fact that scientists are far more interested in pursuing their academic interests than in organizing for political action and are therefore not very effective even on those issues in which they do take an interest.

Illinois. University. Institute of Labor and Industrial Relations.
Collective bargaining for professional and technical employees; conference report, May 20-21, 1965. Urbana, 1965. 53 pp.

Case study approach to the questions raised by group action among highly educated employees. Papers delivered covered the electrical industry, automobile and broadcasting industries, government service (Federal, state and local), and education. Groups specifically mentioned include scientists, engineers, teachers and nurses.

Klaw, Spencer.
The new brahmins; scientific life in America. New York, Morrow, Inc., 1968. 315 pp.

"The aim of this book is to portray the scientific community in the United States: to convey a sense of what it is like to be a scientist in America in a time when science has become a form of established religion, and scientists its priests and ministers."

Based on published material and interviews, explores types of scientific careers, scientists' attitudes and characteristics.

Kleingartner, Archie.
The characteristics and work adjustment of engineering technicians. California management review, vol. 11, no. 3, Spring 1969, pp. 89-96.

Paper examines the social and background characteristics of engineering technicians in the aerospace industry, their incentive and promotional patterns, and the relationship between their work goals and job satisfaction. Results indicate that technicians, caught between being professional engineers and manual workers, want greater attention paid to their own particular needs and interests.

Kleingartner, Archie.
Professionalism and engineering unionism. Industrial relations, vol. 8, no. 3, May 1969, pp. 224-235.

Attitude survey of 202 engineers in two large California aerospace companies each of which has an independent professional union. About half of the interviewees were union members. Engineers showed support for the idea of unionism but were not willing to join themselves. They showed interest in an organization that represents or aids their profession or job related interests, but did not want to become involved with existing unions or an organization that cooperates with unions. Generally, they did not think that unionism was a threat to their professionalism.

Personality and Professional Characteristics of Scientists and Engineers (Cont'd)

Kleingartner, Archie.
Unionization of engineers and technicians. Monthly labor review, vol. 90, no. 10, October 1967, pp. 29-35.
Describes a study to determine the number of engineers and engineering technicians represented by unions in collective bargaining in the U. S., and also to show their distribution among various types of unions. Concludes that unionization is now quite limited but will gradually increase.

Levinson, Harry.
What an executive should know about scientists. Think, vol. 31, no. 5, September-October 1965, pp. 6-10.
Interprets the scientist as the kind of man he usually is, one with a different set of attitudes, life style, and loyalties from others in an organization. Acquaints executives with ways to approach and understand a scientist.

Lombardi, Vincent L.
Engineer attitudes toward employment, professionalism and unionism. Ann Arbor, University Microfilms, Inc., 1967. 153 pp.
Doctoral dissertation, University of Minnesota, 1967. Abstracted in Dissertation Abstracts, vol. 28, no. 3, September 1967, p. 1141A.

Morris, M. D.
Why engineers can't/don't write. Engineer, vol. 10, no. 5, September-October 1969, pp. 15-19.
Maintains that engineers don't write because of poor elementary exposure to English, the use of badly written technical texts, little encouragement and professional help, and an alleged psychological block about communicating. Points out the importance of the engineer being able to express himself.

National Society of Professional Engineers.
Professionalism or unionism; which choice for the engineer in government? Washington, 1966. 5 pp. (NSPE publication no. 1310)
A professional society points to practical and philosophical reasons for its opposition to unionizing engineers in government. Also contained in FPA (Federal Professional Association) journal, vol. 1, no. 1, May 1967, pp. 14-25.

National Society of Professional Engineers.
Tabulation of unions representing engineering and technical employees. Washington, D. C., 1966. 8 pp.

Personality and Professional Characteristics of Scientists and Engineers (Cont'd)

Perrucci, Robert.
The engineer in today's social system--his background, education, and utilization. Journal of college placement, vol. 29, no. 1, October-November 1968, pp. 58-59, 62, 64+.

Reports a study at Purdue University to determine social and intellectual origins, career decisions and motivations, and employment patterns in this profession which will increasingly be involved in large-scale societal problems.

Prandy, Kenneth.
Professional employees; a study of scientists and engineers. London, Faber and Faber, 1965. 197 pp. (Society today and tomorrow).

Mr. Prandy examines the conflict between professional attitudes and trade unionism among scientists and engineers in the context of a theory of social stratification. He then goes on to a fuller analysis of the concepts of social class and social status in contemporary Britain.

Price, Oscar A.
Engineering unions: a decade-long downward curve. Professional engineer, vol. 39, no. 1, January 1968, pp. 23-27.

Suggests reasons for the decline in engineer unionism and foresees a continued waning.

Rickover, H. G.
Needed: a humanistic technology. Professional engineer, vol. 39, no. 5, May 1969, pp. 35-37.

Treats of the professional status of the engineer as compared to that of the members of the "liberal or humanistic" professions.

San Jose State College. Center for Inter-disciplinary Studies. Manpower Research Group.
An examination of the engineering profession, by R. P. Loomba. San Jose, Calif., 1968. 107 pp.

Some of the complex problems facing the engineering profession are identified. These are vocational choice, periodic mass layoffs, the older engineer's plight, and the nature, causes, and remedies for technical obsolescence. Recommendations are offered to alleviate problems.

Strauss, George.
Professionalism and the engineers. In Bakke, Edward W., Clark Kerr and Charles W. Anrod. Unions, management and the public; readings and text. 3d ed. New York, Harcourt, Brace and World, Inc., 1967, pp. 103-105.

Thomas, Charles D.
Professionalism or unionism under Executive Order 10988? Professional engineer, vol. 39, no. 1, January 1968, pp. 28-31.

"In the long run, the only effective way to prevent unions from swallowing up Federal engineers is through the establishment of professional engineering groups under EO 10988."

Personality and Professional Characteristics of Scientists and Engineers (Cont'd)

Vollmer, Howard M.
Work activities and attitudes of scientists and research managers: data from a national survey. Menlo Park, Calif., Stanford Research Institute, 1965. 218 pp. (R&D studies series)
Presents basic data compiled from national survey of scientists and research managers in biology, chemistry, mathematics, and physics. Report is intended to provide basic source of information on organizational relations, activities, and attitudes of scientists and research managers in a variety of contexts throughout the United States.

Williamson, Merritt A.
Identifying the engineering profession. Professional engineer, vol. 39, no. 9, September 1969, pp. 57-60.
The National Society of Professional Engineers Professional Identity Committee presents proposed standards for professional and accredited engineers and invites comments from readers on the appropriateness of these standards.

Williamson, Merritt A.
Professional identity for engineers. American engineer, vol. 38, no. 7, July 1968, pp. 45-50.
The Chairman of the National Society of Professional Engineers, Professional Identity Committee considers the reasons for the need for professional identification and the criteria involved.

IDENTIFYING AND DEVELOPING SCIENTIFIC CREATIVITY

Abelson, Philip H.
Relation of group activity to creativity in science. Daedelus, vol. 94, no. 3, Summer 1965, pp. 603-614.
Reviews some of the benefits to creativity arising from group interactions citing examples of famed scientists. Effective means of insuring a favorable mutual stimulus lies in choice of group members and setting a common goal.

Allison, David.
The growth of ideas. International science and technology, no. 67, July 1967, pp. 24-32.
In an attempt to throw light on the process of invention and innovation, author sketches two studies: Project Hindsight and a study of ten technological accomplishments. He finds no formula by which the innovative process can be described.

Andrews, Frank M.
Factors affecting the manifestation of creative ability by scientists. Journal of personality, vol. 33, no. 1, March 1965, pp. 140-152.
Description of an experiment on 214 scientists to determine how the relationship between creative ability and creative performance is affected by the following social psychological variables: strength of motivation, probability of deciding to communicate ideas, adequacy of communication channels, and probability of ideas being received.

Andrews, Frank M.
Supervisory practices and innovation in scientific teams. Personnel psychology, vol. 20, no. 4, Winter 1967, pp. 499-515.
Reports a study conducted in a NASA research center which found that the supervisor plays a major role in enhancing or depressing innovation. It also found that innovation tended to be low when supervisors were thought to be effective at human relations or administration, or both.

Argyris, Chris.
Interpersonal competence, organizational milieu, and innovation. Research management, vol. 9, no. 2, March 1966, pp. 71-99.
Reports a study on the effects on research creativity of internal organizational environments.

Buel, William D.
Biographical data and the identification of creative research personnel. Journal of applied psychology, vol. 49, no. 5, October 1965, pp. 318-321.
"Biographical data items were weighted and cross-validated for the identification of creative research personnel. Significant ... correlations are presented between no previous experience... and previous experience... keys and a variety of creativity criteria. A behavioral and perceptual image of the creative scientist is presented, together with a discussion of the communality inherent in various criteria of creativity." References.

Identifying and Developing Scientific Creativity (Cont'd)

Chambers, Jack A.
Relating personality and biographical factors to scientific creativity. Ann Arbor, Mich., University Microfilms, Inc., 1965. 96 pp.
"This study is concerned with the personal traits differentiating highly creative research scientists from less creative ones, of those distinguishing psychologists from chemists, and with those biographical factors in scientists' lives which are important in determining the choice of professions within science, and achievement of creative productivity within the profession."
Doctoral dissertation, Michigan State University, 1964. Abstracted in Dissertation Abstracts, vol. 26, no. 3, September 1965, p. 1762.

Danielson, Lee E.
Engineers, scientists and suggestion systems. NASS quarterly, vol. 2, Spring 1966, pp. 8-11.
Aids to a suggestion system for scientists and engineers, obstacles to a system and how they may be overcome.

DeSimone, Daniel V., ed.
Education for innovation. New York, Pergamon Press, 1968. 180 pp.
Volume based on major presentations at a Woods Hole conference which examined the creative process of innovation and opportunities for encouraging and supporting creative engineering education.
Selected contents: Education for creativity, by C. Stark Draper; Factors influencing creativity, by Calvin W. Taylor; Educating prospective inventors, by Jacob Rabinow; Preparing innovators and entrepreneurs, by Richard S. Morse.

Feinberg, M. R.
14 suggestions for managing scientific creativity. Management review, vol. 57, no. 12, December 1968, pp. 25-29.
Guides for spotting and stimulating creative people and 14 rules for supervising them. Condensed from Research Management, vol. 11, no. 2. 1968.

Fox, H. Herbert.
Creativity in the sciences. AAUW journal, vol. 58, no. 4, May 1965, pp. 168-171.
"In effect, therefore, the principal function of science is to be creative in the discovery of those relative truths by which we increase our understanding of the world around us and our ability to manipulate its forces to our needs."

Gamble, Allen O.,
NASA's efforts and interest in creativity. In Utah. University. Research Conference on the Identification of Creative Scientific Talent, 5th, 1962. Widening horizons in cerativity, ed., by Calvin W. Taylor. New York, John Wiley and Sons, Inc., 1964, pp. 410-413.
Briefly discusses the "breadth-of-applicability concept" for the evaluation of a scientists's research in terms of hiring or promotion and outlines possible areas of research into creativity using NASA's personnel.

Glaser, Barney G.
"Differential association" and the institutional motivation of scientists. Administrative science quarterly, vol. 10, no. 1, June 1965, pp. 82-97.

"The purpose of this paper is to suggest a generalized formulation of one set of generic conditions that strongly motivate a scientist to participate in the goal-reward pattern of science. These conditions are the differential associations of the scientist with colleagues who guide his induction into science, colleagues who continually make known to the scientist that it is his job to advance knowledge. The impact of these differential associations on generating degree and firmness of motivation to advance knowledge varies according to their diversity of scope but not to the duration of the associations."

Hertz, David B.
The successful innovators. McKinsey quarterly, vol. 2, no. 1, Summer 1965, pp. 2-10.

Five keys to successful innovation uncovered by a McKinsey and Company study are: the commitment of top management to research goals; involvement of research scientists with management goals; selection of programs for research; organization of manpower resources; and application of results attained Analysis indicates that innovators are as important on the exploitation and development side of the picture as on the research side. Successful inventiveness has been achieved by exposing researchers to other company activities and by exposing marketing and manufacturing people to research.

Howard, George W.
Managing creative personnel. Personnel administration, vol. 30, no. 5, September-October 1967, pp. 32-37.

Examines problems that may arise in managing creative personnel in the science and engineering areas. Suggests that the manager inform his employees of the realities of their working environment while encouraging their innovative talents.

Isenson, Raymond S.
Group creativity: a research planning tool. Personnel administration, vol. 27, no. 6, November-December 1964, pp. 36-38.

Explains Army Research Office approach to group creativity and describes various advantages, pitfalls, and requirements as revealed by experimental use of this research method.

Kellner, Arthur D.
How to manage creativity. Professional engineer, August 1969, pp. 45-48.

Points out blocks to creativity in the technical environment. Sees personal involvement as a major element in a healthy organizational climate and lists approaches which can be used by engineering management to engender participation.

Kubie, Lawrence S.
Blocks to creativity. International science and technology, no. 42, June 1965, pp. 69, 71, 72+.

Advocates changes in the education of scientists and engineers that will help rather than hinder the creative process.. The author, a psychiatrist, feels that neurotic mechanisms, which can block all effective patterns of scientific creativity, could be rendered less powerful by bettering tools of communication and placing less emphasis on "drill and grill" educational processes. Explains the unconscious and preconscious basis of thinking.

Identifying and Developing Scientific Creativity (Cont'd)

Linder, C. T. and R. A. Connor, Jr.
Creativity and innovation for the industrial research laboratory. Research management, vol. 8, no. 4, 1965, pp. 219-228.
"A plan of action for fostering the creativity and innovation of applied research laboratory personnel."

McDermid, Charles D.
Some correlates of creativity in engineering personnel. Journal of applied psychology, vol. 49, no. 1, February 1965, pp. 14-19.
Results of a study carried out in an applied engineering division of a company manufacturing consumer goods "confirm other research findings which suggest that self-reports and biographical data, especially those which describe interests or achievements of a creative nature, are currently the most effective predictors of creative performance in real-life situations."

McPherson, Joseph H.
The creative engineer. Midland, Michigan, Hawkins Publishing Company, 1965. 19 pp.
Addressing himself to the managers of engineers, the staff psychologist of the Dow Chemical Company first writes of the truly creative engineer. Then he endeavors to explain the different types who need to be stimulated to creativity and commitment. He concludes with recommendations to supervisors.

McPherson, Joseph H.
How to manage creative engineers. Mechanical engineering, vol. 87, no. 2, February 1965, pp. 32-36.
Recommends to the administrator ways in which he may serve as a catalyst for creativity. Discusses characteristics of creative peole, the creative partnership, road blocks to creativity, and the development of skills.

Mink, Earl P.
Some aspects of stimulating and nurturing creative thinking and innovation in basic research in organizations. n. p., The Author, 1967. 95 pp.
Major research question is what National Institutes of Health, Naval Ordnance Laboratory, and Agricultural Research Center are doing to stimulate their scientists to produce creative research. Recommendations cover areas of organizational climate, flexibility in management policies, training programs and pay. Extensive bibliography.
Master's thesis, George Washington University, 1967.

Neidt, Charles O. and Richard W. Drebus.
Characteristics associated with the creativity of research scientists in an industrial setting. Journal of industrial psychology, vol. 2, no. 4, December 1964, pp. 102-111.
Study relates descriptive, intellectual and non-intellectual characteristics to creativity and finds that the creative research scientist is a well adjusted individual with an especially high ability to perceive relationships. Data indicate "that creativity is associated with a particular combination of characteristics rather than with any single factor...."

Offner, David H.
Energizing the creative potential in future engineers. Journal of creative behavior, vol. 1, no. 1, Winter 1967, pp. 15-21.
"Three agents needed for energizing the creative process in future engineers are realistic challenge, creative involvement, and relevant constraints. Two conditions for continuing the reaction are a reservoir of knowledge and experience, and an integrated conceptual framework. Curricula and courses can be structured to emphasize these agents and conditions."

Royer, George L.
The climate for creativity: one company's approach to managing technical personnel. Personnel, vol. 44, no. 3, May-June 1967, pp. 54-58.
"The author describes how American Cyanamid Company has organized its Stamford Research Laboratories to encourage the greatest possible contribution from scientific and technical personnel."

Tucker, Michael F., Victor B. Cline and James R. Schmitt.
Prediction of creativity and other performance measures from biographical information among pharmaceutical scientists. Journal of applied psychology, vol. 51, no. 2, April 1967, pp. 131-138.
Recent studies in the identification and prediction of scientific talent through use of biographical information as predictor data indicates a high validity rate in forecasting of creativity among these scientists.

Walkup, Lewis E.
Letter to a new manager. Science and technology, no. 81, September 1968, pp. 60-66.
A manager of scientific research must be especially concerned with fostering creativity and providing a stimulating productive atmosphere for creative men. Author suggests ways for a new manager to approach such a task.

Wiesner, Jerome B.
Education for creativity in the sciences. Daedalus, Summer 1965, pp. 527-537.
Discusses the characteristics of an educational methodology necessary to insure a supply of scientists who can maintain creative production even in view of the information explosion. Among the characteristics mentioned are " ingraining the habit of maintaining a skeptical, actively critical point of view toward all knowledge" and "encouragement of stimulation of imaginative and unconventional interpretations of experience in general."

ORGANIZATIONAL, MOTIVATIONAL AND SUPERVISORY FACTORS AFFECTING PERFORMANCE

FEDERAL GOVERNMENT RESEARCH ORGANIZATIONS

Andolsek, L. J.
Remarks. In U. S. Federal Council for Science and Technology. The environment of the Federal laboratory. Proceedings, third symposium, December 7-8, 1964, pp. 76-80.
Science and technology are pervading every fabric of our modern society. These advances have made an impact on the skills and educational attainments required of the nation's work force. With the high degree of talent and capability being demanded, the structure of education and skills must be elevated. The effects of this are already being felt in the Federal work force.

Auman, George E.
What environment--for whom? Civil service journal, vol. 7, no. 1, July-September 1966, pp. 6-11.
Report on a survey conducted by the Standing Committee of the Federal Council for Science and Technology. Survey dealt with environmental values of Federal scientists and engineers. Article includes questionnaire and a chart indicating the ranking of the ten most important and ten least important factors.

Barkley, Bruce T.
The program management officer in the public service: his role in policy formulation and administration. Public administration review, vol. 27, no. 1, March 1967, pp. 25-30.
The program management officer in the Public Health Service combines line and staff functions as a scientist concerned with the administration of scientific programs. The author notes variations in his roles and functions and lists basic qualities needed in the position.

Braithwaite, Karl R.
Scientists and public officials; relations in oceanography. Ann Arbor, Mich., University Microfilms, Inc., 1968. 234 pp.
Based on interviews with academic, government, industry and congressional people, study depicts the relationship between scientists and public officials in the field of oceanography and the current Federal facilities and organization for oceanographic research.
Doctoral dissertation, University of Wisconsin, 1967. Abstracted in Dissertation Abstracts, vol. 28, no. 12, pt. 1, June 1968, p. 5112-A.

Carter, Luther J.
Federal laboratories: are they adjusting to changing needs? Science, vol. 154, no. 3756, December 23, 1966, pp. 1529-1530.
Reports on information contained in a congressional document issued by the Research and Technical Programs Subcommittee of the House Committee on Government Operations, "A Case Study of the Utilization of Federal Laboratory Resources," and on the significance of questions raised.

Federal Government Research Organizations (Cont'd)

Chandler, Herman R.
Motivation of engineers under civil service and the systems management concept with a method of program evaluation. Alexandria, Va., Defense Documentation Center, 1966. 71 pp.
"This study will develop methods of motivation with a strong emphasis on communication or keeping employees informed. Methods in industry are studied for possible use when the Incentive value could justify adoption. Information is presented to validate exceptional supervisory effort in keeping employees informed."

Coffey, John A.
While tracking the skies, 'let scientists do science and administrators do administration'. Civil service journal, vol. 10, no. 1, July-September 1969, pp. 6-9.
The Executive Officer of the Smithsonian Institution's Astrophysical Observatory in Cambridge, Mass., reviews some of the changes in the operations of a research center that have resulted from the growth of "big science." He points out the need for first rate scientists, the benefits of associating with a university research center and the value of separating science and administration. He stresses the need of scientists for freedom and a flexible work atmosphere.

Crook, Leonard T.
The engineer and the Federal employee-management cooperation program. American engineer, vol. 35, no. 7, July 1965, pp. 39-42.
Reports on the part played by the National Society of Professional Engineers in the background of Executive Order 10988 and the paths open to engineers under it. Explains the difference between collective bargaining in private industry and as it exists under the Executive Order. Tells of the policy of the National Society under the Executive Order and of its effectiveness.

Crowley, Michael F.
Scientists and engineers: a fast paced employment expansion. Occupational outlook quarterly, vol. 13, no. 2, Summer 1969, pp. 25-27.
Supplies the statistical growth patterns of manpower in science and engineering in the last two decades. Unprecedented growth is directly related to new and expanded programs in research and development, defense, space exploration, atomic energy, health and higher education.

Dysinger, Dale W.
Motivational factors affecting Army research and development personnel. Alexandria, Va., Defense Documentation Center, 1966. 62 pp.
(Technical research report 1149, contract no. DA 49-092-ARO-32)
Reports an investigation of factors in the individual research scientist and in the work environment which contribute to positive and negative motivation of the civilian research staff.. "Interesting and challenging work" and"freedom to work in their own way" were found to be major components of job satisfaction.

Federal Government Research Organizations (Cont'd)

Ginsburgh, David M.
The navy's corporate laboratory. Civil service journal, vol. 7, no. 2, October-December 1966, pp. 28-29.
A sketch of the focal point of research and development for the U. S. Navy--the Naval Research Laboratory.

Kozik, Eugene.
Rationalization of administrative planning for research and development activities. Alexandria, Va., Defense Documentation Center, 1958. 99, 20 pp.
"This report treats the complexities of the framework within which Air Force R & D activity takes place. This is followed by a discussion of some of the processes and problems of R & D administration at the top management level and at the laboratory, or actual operational level. An appraisal of the methodology used in the preparation of this report is contained in the final chapter." Data was gathered largely through interviewing administrators and recording their knowledge and viewpoints. Appendix contains case studies.

Lee, Sang M.
Organizational identification of scientists. Academy of Management journal, vol. 12, no. 3, September 1969, pp. 327-337.
Questionnaires were returned by 170 employees of a division of the U. S. Public Health Service, all of whom were regular employees, with at least a bachelor's degree and whose primary responsibilities were in professional scientific work. The survey was designed to determine the degree of personal identification with the organization. Those "scientists with high professional prestige and high organizational prestige demonstrated the highest organizational identification...."

Leiserson, Avery.
Scientists and the policy process. American political science review, vol. 59, no. 2, June 1965, pp. 408-416.
"The present paper...attempts ...to do three things: (1) to identify the principal concepts and models that postulate the separation...between the political framework of coercive public authority and the voluntary, established organization of scientific effort in society, and in so doing to make explicit certain attributes and characteristics of science and scientists viewed as a political constituency; (2) to report some findings from a study of scientists in the Executive Office of the President...; and (3) to distinguish several major different types or patterns of policy-making affecting science."

Federal Government Research Organizations (Cont'd)

Little, Arthur D., Inc.
Management factors affecting research and exploratory development. Alexandria, Va., Defense Documentation Center, 1965. 1 v.

"The central problem of this study is to discover relations between the technical, organizational and fiscal environment surrounding research and exploratory development projects and the degree to which results of these projects are subsequently utilized. Particular attention will be paid to finding environmental patterns associated with successfully utilized research and development, and to finding relations which might allow the Defense Department purposefully to influence potential utilization by selecting or controlling environmental factors."

MacArthur, Donald M.
Personnel management for research and development. Journal of Navy civilian manpower management, vol. 2, no. 3, Fall 1968, pp. 19-22.

DOD laboratories, according to the author, often cannot measure up to industry's laboratories in terms of flexibility, personnel, and general management. As a result of this problem, the Civil Service Commission conducted an investigation to determine just how much change and innovation is possible within the civil service system. The findings were that "eighty-nine percent of the problems they identified are resolvable within the framework of existing legislation and civil service rules and regulations. Thus MacArthur suggests that it is up to the personnel departments to develop ways to give the R & D managers this flexible, creative environment."

See also "Personnel management for R & D" (Personnel Administration, vol. 31, no. 5, September-October 1968, pp. 28-35. Both articles adapted from speech given to Washington Section of the Society for Personnel Administration, February 28, 1968.

Macy, John W., Jr.
Bridging the science-management gap in government. In Society for the Advancement of Management. Proceedings of the annual conference. New York, 1965, pp. 67-71.

Marcson, Simon.
Scientists in government; some organizational determinants of manpower utilization in a government laboratory. New Brunswick, N. J., Rutgers University, 1966. 595 pp.

Report of an investigation of the U. S. National Aeronautics and Space Administration's Goddard Space Flight Center "(1) to discover if the governmental working environment develops significantly discernible consequences for the utilization of scientists and engineers; and (2) to find out what could be learned about motivation and productivity in a government laboratory..."

Includes studies of U. S. Civil Service Commission rules and procedures in a working environment of the professional staff and career development, and of organizational factors affecting employment in a government laboratory. There are chapters on scientists' and engineers' perceptions of a government laboratory, rewards and motivation, and managing change.

Schein, Edgar H. and others.
Career orientations and perceptions of rewarded activity in a research organization. Administrative science quarterly, vol. 9, no. 4, March 1965, pp. 333-349.

Report of an experiment in two field centers of the National Aeronautics and Space Administration. "The low degree of correlation among the career orientation dimensions /of scientists and engineers/ supports the conclusions that a profile based on these five dimensions /two career-identification and three career-style/ may be more accurate and useful than single dimensions.

Federal Government Research Organizations (Cont'd)

Strauss, Paul S.
Job satisfaction, productivity and job activities of Federal engineers and scientists; an application of growth and belonging theory. Ann Arbor, Mich., University Microfilms, Inc., 1966. 183 pp.
"It is evident from the results of this study that however dysfunctional bureaucracy may be, it can provide the elements of Growth and Belonging related to high job satisfaction and productivity."
Doctoral dissertation, New York University, 1966. Abstracted in Dissertation Abstracts, vol. 27, no. 4, October 1966, p. 1113-A.

U. S. Congress. House. Committee on Science and Astronautics.
Utilization of Federal laboratories. Report ... Washington, U. S. Govt. Print. Off., 1968. 68 pp. (H. comm. print. 90th Cong.)
This report of the Subcommittee on Science, Research, and Development points out shortcomings in the present Federal laboratory system and makes recommendations. It proposes greater interagency use of Federal laboratories and shows that they can be useful in solving such national problems as crime, transportation or pollution.
Representative Daddario, Chairman.

U. S. Department of Defense.
Joint program of the Civil Service Commission and the Department of Defense to resolve problems in the management of Defense in-house laboratories. Prepared by Office of the Director of Defense Research and Engineering, Office for Laboratory Management. Washington, 1969. 65 pp. (Management analysis memorandum 69-2)

U. S. Department of Defense.
Problems of the in-house laboratories and possible solutions. Alexandria, Va., Defense Documentation Center, 1966. 63 pp. (Management analysis memorandum 66-3)
At the direction of the Director of Defense Research and Engineering, a study was made of management problems of in-house laboratories in the Department of Defense. This report summarizes the responses of the Military Departments to a series of questions posed in the study.

U. S. Department of Defense.
Profile of civilian scientists and engineers in field RDT&E activities of the Department of Defense, by E. C. Haberman and E. M. Glass, Office of the Director of Defense, Research and Engineering, Office for Laboratory Management. Washington, 1969. 25 pp. (Management analysis report 69-1)
Survey of 26,437 civilian employees of the Department of Defense. Covers educational levels, occupations, supervisory levels, mobility, women in science and engineering, patent applications, papers published, attendance at meetings, grade distribution, salaries, etc.

U. S. Department of Health, Education, and Welfare.
Report of the Career Service Board for Science..., December 23, 1968. Washington, U. S. Govt. Print. Off., 1969. 1 v.
The mission of the Career Service Board for Science is to establish and help maintain a stimulating environment for HEW's professional staff in the sciences and related fields. This report covers such efforts as related to salary, personnel interchange, writing and publishing, outside professional participation, awards, promotions, and other incentives, and the provision of adequate support services.

Federal Government Research Organizations (Cont'd)

U. S. Federal Council for Science and Technology.
Education and the Federal laboratories; an assessment of Federal laboratory educational activities and their present and potential relationships with universities. Prepared by Committee on Federal Laboratories. Washington, 1968. 90 pp.

Sections on university-laboratory relationships, the interchange of personnel and equipment, and the use of government facilities. Summary of 9 recommendations for extending university-government laboratories collaboration.

Dr. Allen V. Astin, Chairman, Committee on Federal Laboratories.

U. S. Federal Council for Science and Technology.
The environment for quality; a report on the identification and evaluation of employment features important to the recruitment, retention, and effective utilization of superior scientists and engineers in the Federal service. Prepared by the Standing Committee. Washington, 1966. 1 v.

An undertaking to analyze differences in environmental factors of Federal R and D establishments which are attractive to various kinds of scientists and which affect their work satisfaction and retention.

U. S. Federal Council for Science and Technology.
The environment of the Federal laboratory. Proceedings of Third Symposium, December 7-8, 1964. Washington, U. S. Govt. Print. Off., 1965. 125 pp.

Symposium sponsored jointly by the U. S. Civil Service Commission. Remarks by Chairman John W. Macy, Jr. and Commissioner L. J. Andolsek.

Selected contents: Employment features important to scientists and engineers--findings from a recent FCST Committee survey, Dr. Allen V. Astin; Inflexibilities in the Federal service--inherent or management choice (including "Implementation of recommendations from a number of government surveys," by Dr. O. Glenn Stahl). Discussions covered housing and equipping Federal research facilities; outside professional activities of Federal laboratory personnel and of Federal employees; the use and significance of attitude surveys in the management of R and D; personnel interchange between government, universities, and industry; professional training and development; and selection and training of research administrators.

Federal Government Research Organizations (Cont'd)

U. S. Federal Council for Science and Technology.
Management and the marginal employee; an analysis of personnel practices to prevent and treat the problem. Washington, 1966. 15 pp.

"This report identifies management resources, policies, and procedural steps presently available to deal with this range of problems; identifies additional resources and authority that are needed; and includes a number of recommendations to improve the situation." Concern is with marginal and unproductive employees who create frustrations for Federal managers and supervisors of research and development.

U. S. Library of Congress. Legislative Reference Service.
A case study of the utilization of Federal laboratory resources. A study submitted to the Research and Technical Programs Subcommittee of the Committee on Government Operations, prepared by Science Policy Research Division... Washington, U. S. Govt. Print. Off., 1966. 141 pp. (H. comm. print, 89th Cong.)

Includes inventory of facilities, personnel, and projects, as well as historical survey of research and development in the Federal government with specific mention made of all major reports. Includes chapter on R & D in environmental pollution.

U. S. Library of Congress. Legislative Reference Service.
Centralization of Federal science activities. Report to the Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, U. S. House of Representatives... Washington, U. S. Govt. Print. Off., 1969. 108 pp. (H. Comm. print, 91st Cong.)

Major functions of Federal government, present and proposed organization, and pros and cons of proposed change.

Vollmer, Howard M. and William C. Pedersen.
The role and career development of the scientific and engineering officer in the Air Force. Menlo Park, Calif., Stanford Research Institute, 1966. 82 pp. (R & D studies series)

Shows that the U. S. Department of Defense, and especially the Air Force, is becoming a technology management organization, needing scientific and engineering officers current in both scientific and technical management and military skills. To retain them it must enhance their professional status. The Air Force in-house laboratories provide appropriate assignments to develop these technology management generalists.

Wachs, Melvin W.
The Federal laboratory scientific and technical director. In U. S. Civil Service Commission. University-Federal Agency Conference. Bloomington, Indiana, November 7-10, 1965. Washington, 1965, pp. 33-37.

"The final paper in the 'profile' series examines the background, educational and job experience, occupational categories and career development of the Federal civilian laboratory, technical and scientific director."

Federal Government Research Organizations (Cont'd)

Yovits, M. C. and others, eds.
Research program effectiveness. Proceedings of the conference sponsored by the Office of Naval Research, Washington, D. C., July 27-29, 1965. New York, N.Y., Gordon and Breach, Science Pub., Inc., 1966. 542 pp.

Selected contents: New tools for improving and evaluating the effectiveness of research, by I. H. Sher and E. Garfield; The role of the research administrator, by C. W. Churchman, C. E. Kruybosch, and P. Ratoosh; Organizational factors in project performance, by D. G. Marquis and D. M. Straight, Jr., Conflict and performance in R & D Organizations: some preliminary findings, by W. M. Evan; Behavior and self-identity of Federal scientist-administrators, by E. S. Uyeki.

ORGANIZATIONAL, MOTIVATIONAL AND SUPERVISORY FACTORS AFFECTING PERFORMANCE INDUSTRIAL ORGANIZATIONS

Abrahamson, Mark.
The integration of industrial scientists. Administrative science quarterly, vol. 9, no. 2, September 1964, pp. 108-118.
Explores "socialization" of scientists into their industrial firms by considering variables which bear upon this integration: (1) amount of academic training; (2) desire for basic research; (3) length of industrial experience; (4) cosmopolitanism; (5) autonomy; (6) organizational size; and (7) size of laboratory.

Abrahamson, Mark.
The professional in the organization. Chicago, Ill., Rand McNally and Company, 1967.
Areas covered are: The socialization of future professionals; organization structure, control, and professional norms; and the management of strain. Selected contents: Informal groups in the research laboratory, by Mark Abrahamson; The integration of industrial scientists, by Mark Abrahamson; Research collaboration between professional practitioners and behavioral scientists, by James K. Skipper, Jr., Donna K. Diers and Robert C. Leonard.

Allen, Thomas J. and Stephen I. Cohen.
Information flow in research and development laboratories. Administrative science quarterly, vol. 14, no. 1, March 1969, pp. 12-19.
Study verified the hypotheses that within a scientific laboratory those who keep up with current literature in the field and/or who maintain a given degree of contact with members of the scientific and technological community outside of their own laboratory, thereby become "gatekeepers" and are the ones most often consulted by their peers.

American University. Institute on Research Administration.
The fundamental research activity in a technology-dependent organization. A selection of papers presented at the Tenth Institute on Research Administration, held 26-29 April 1965, Washington, D. C. ... edited by Howard M. Vollmer. Springfield, Va., Clearinghouse for Federal and Scientific Technical Information, 1965. 103 pp. (AD 628 747)
Partial contents: Scientists in a technology-oriented organization--their expectations, incentives, and career patterns, by Donald G. Marquis; The organization of science in a technology-oriented organization, by Howard Reiss; Work unit effectiveness in a scientific organization, by Floyd Mann; The Air Force Office of Scientific Research as an Air Force activity to utilize the extramural science-oriented community, by William J. Price; Managerial principles for planning research for industry and government, by Lawrence W. Bass.

Industrial Organizations (Cont'd)

Beer, Michael.
Match your motivating strategy to different engineer types. American engineer, vol. 38, no. 5, May 1968, pp. 42-46.
The differences in managing research engineers and organization engineers are described with reference to theory and research in motivation. Particularly considers the need to reward research engineers in a way to motivate them toward continued research rather than management.

Beeson, H. C. and J. W. Hodges.
Factors affecting the morale and productivity of engineering personnel. Oak Ridge, Tenn., U. S. Atomic Energy Commission, 1967. 177 pp.
Based on a study by the authors as partial fulfillment of requirements for the degree of Master of Science in Industrial Management, University of Tennessee.
Research conducted with engineering personnel at Union Carbide Corporation, Nuclear Division, to determine which supervisory practices and incidents resulted in improved morale and productivity level change as measured by engineering design drawing production. Includes presentation of data from a number of other related studies.

Biaggini, Benjamin F.
The chief executive and the specialist. Advanced management journal, vol. 32, no. 3, July 1967, pp. 20-25.
Changing technology has created a demand for specialists, and a problem in incorporating these people into the organization. The article cites the Southern Pacific Company's TOPS program, (Total Operations Processing System Project), and briefly describes the program's design and implementation.

Bogaty, Herman.
Employees of technical organizations can be motivated. Research management, vol. 12, no. 1, January 1969, pp. 5-24. S/C
An overview of general studies on motivation in industry is followed by consideration of the ways they apply to technical and scientific personnel. Suggestions for R and D managers are given.

Brown, Warren B. and L. N. Goslin.
R and D conflict: manager vs. scientist. Business topics, vol. 13, no. 3, Summer 1965, pp. 71-79.
Urges a flexible organization chart for R and D, with both management and technical people giving leadership. This would obviate some of the problem areas concerning authority conflicts, organization size and goal conflicts. Reminds that the scientist often prefers the colleague system of authority relationship instead of the business type of authority hierarchy.

Industrial Organizations (Cont'd)

Dalton, Gene W., Louis B. Barnes and Abraham Zaleznik.
The distribution of authority in formal organizations. Boston, Harvard University, Graduate School of Business Administration, Division of Research, 1968. 229 pp.

A field experiment approach was used to assess the effects of changes in organizational structure and arrangements in a research and development center on the satisfaction and productivity of the professional personnel. Subjects for the study were 150 engineers, scientists and managers performing development work under a newly promoted scientist-executive director.

Dalton, Melville.
Changing staff-line relationships. Personnel administration, vol. 29, no. 2, March-April 1966, pp. 3-5, 40-48.

Report of an experiment to eliminate staff and line conflict at the Transode Corporation, an electronics firm hiring scientists and engineers. It contrasts a new pattern of relationships with the traditional and describes how friction and conflict were minimized.

Duke, E. E.
Industrial management and its effect on performance of highly technical personnel. Personnel journal, vol. 45, no. 6, June 1966, pp. 346-351, 378.

Author believes that scientists are most effective under Theory Y management and that creativity and productivity are being lost due to over-control and regulatory strictures. Includes results of survey of 200 scientists of their opinions on management and control.

Evan, William M.
Superior-subordinate conflict in research organizations. Administrative science quarterly, vol. 10, no. 1, June 1965, pp. 52-64.

"In a governmental and an industrial research organization, non-supervisory engineers and scientists, first-level supervisors, and second-level supervisors were asked about conflicts with their superiors. The incidence of superior-subordinate conflicts is positively associated with organizational position in both laboratories. There is a tendency for technical conflicts to decrease and administrative conflicts to increase with organizational position. Despite the absence of a formal appeal system in the industrial laboratory, an unexpectedly high proportion of respondents perceive the institutionalization of due-process norm, which suggests the functioning of an informal appeal system. The emergence of an informal due-process mechanism in the industrial laboratory is probably a response to pressures to constitutionalize the corporation."

Forchheimer, Otto L.
Management's role in R & D. Advanced management journal, vol. 32, no. 2, April 1967, pp. 60-65.

"The company, through top management, must establish good communications with its research and development staff and inform them of major policies of the organization. Poor communications can only lead to frustration in the R & D function."

Industrial Organizations (Cont'd)

French, Earl B.
The organization scientist: myth or reality. Academy of Management journal, vol. 10, no. 3, September 1967, pp. 269-273.
Questions William H. Whyte's basic thesis in The Organization Man that "success within organizational life is more related to one's personality characteristics or interpersonal competence than to knowledge and technical skills." On the basis of a review of additional evidence suggests that, at least as far as scientists and engineers are concerned, this is neither entirely true or false but depends on the organizational position, either "bench" or managerial. Suggests new research to determine the validity of this hypothesis.

French, Earl B.
Perspective: the motivation of scientists and engineers. Academy of management journal, vol. 9, no. 2, June 1966, pp. 152-155.
"The purpose of this article is to bring together a summary of research on motivation of scientists and engineers in combination with data from interviews with ten scientists and engineers in a large research and development laboratory." Bibliography.

Friedlander, Frank.
Motivations to work and organizational performance. Journal of applied psychology, vol. 50, no. 2, April 1966, pp. 143-152.
"Measures of 3 types of motivation of work were related to 2 criteria of job performance, both of which reflect the degree to which the organization has rewarded individual behaviors." Two groups were used in the experiment: one, the white-collar sample was composed of government scientists, engineers and support personnel; the other, the blue collar sample, consisted of people in various trades. References.

General Electric Company. Behavioral Research Service.
Factors which influence careers in General Electric, by S. H. Peres. Crotonville, N. Y., 1966. 63 pp.
Study was conducted to identify some of the personal and organizational factors which affect engineers' salary success in General Electric. Some personal factors investigated were the impact upon career progress of the individual's concept of what "pays off" in General Electric, job characteristics that were seen as most appealing, and something about the individual's approach to problem solving. Organizational factors investigated were impact of first full time job assignment in the company, what happened to man's bosses, and extent of individual's participation in special task forces or similar assignments.

Industrial Organizations (Cont'd)

Glaser, Barney G.
Stabilizing scientists' careers. Personnel administration, vol. 28, no. 1, January-February 1965, pp. 3-5, 15-18.
Findings from a recent study of the organizational careers of scientists indicate that those with the most stable careers (those having security of position, provision for upward progress, and a pace of advancement allowing for thoughtful research without fear of loss of security) are the most highly motivated, productive and creative.
Shows how a "career prospective" can help administrators stabilize scientific careers.

Glatt, Evelyn.
Professional men and women at work: a comparative study in a research and development organization. Ann Arbor, Mich., University Microfilms, Inc., 1966. 321 pp.
Doctoral dissertation, Case Institute of Technology, 1966. Abstracted in Dissertation Abstracts, vol. 27, no. 6, December 1966, pp. 1926A-1927A.

Gmitter, George T.
The industrial R & D scientist and his environment. Research management, vol. 9, no. 2, March 1966, pp. 115-131.
"While the typical informal organization in R & D provides some satisfaction of the needs of its professional staff, a better integration of the informal with the formal organization is proposed for greater productivity, and greater fulfillment of its members' needs." Advocates participative management in R & D as most effective.

Goldner, Fred H. and R. R. Ritti.
Professionalization as career immobility. American journal of sociology, vol. 72, no. 5, March 1967, pp. 489-502.
"Examination of the use of professional career ladders in industry indicates that power is the ignored variable that obviates the usefulness of such a structure for engineers and other professionals whose work requires coordination or the allocation of scarce resources. Although engineers differ from other professionals in a number of ways, analysis of their place in large organizations throws doubt on the utility of the concept of professionalism for understanding large, complex organizations."

Graen, George B.
Motivator and hygiene dimensions for research and development engineers. Journal of applied psychology, vol. 50, no. 6, December 1966, pp. 563-566.
"Herzberg's 2-factor theory /of job satisfaction/ appears to offer promising leads to new research on work motivation. ... The purpose of this study was to develop psychometric measures of ... work factors through the method of factor analysis."

Industrial Organizations (Cont'd)

Graen, George B., Rene V. Dawis and David J. Weiss.
Need type and job satisfaction among industrial scientists. Journal of applied psychology, vol. 52, no. 4, August 1968, pp. 286-289.
"Need fulfillment theories of job satisfaction generally assume that individuals differ in the outcomes they prefer (need) to obtain from their jobs. ... The hypothesis this study investigated is that the pattern of preferences for job outcomes moderates the relationship between preference for an outcome and satisfaction with that outcome."

Griffiths, William E.
Supervising technical-specialist personnel. Public personnel review, vol. 26, no. 3, July 1965, pp. 169-171.
"As the work force changes, so too must supervision." The increase in the number of highly trained specialists in the work force places unique demands upon the supervisor. Author discusses ways in which to constructively supervise specialists, pointing out their distinctive attributes, their need to know the structure of their organization-employer, the amount of supervision required, and their share in leadership and organizing functions.

Hamberg, Daniel.
R & D; essays on the economics of research and development. New York, Random House, 1966. 170 pp.
Includes section on human factors in the industrial research laboratory in which the creative scientist, the clash of traits, limitations of team research and the research committee are discussed.

Hill, Walter A.
The beginning engineer's job: some conflicting perceptions. Journal of college placement, vol. 25, no. 3, February 1965, pp. 121-122, 124, 126, 128+.
Text and tables provide findings of research to measure and compare job perceptions of engineering students and supervisors. Suggestions are made to help alleviate the perceptual differences which cause difficulties in molding the beginning engineer into an effective member of the engineering team.

Kipp, Egbert M.
People aspects; attracting and retaining R and D personnel. New York, Gordon and Breach Science Publishers, 1967. 104 pp.
Suggestions on how to build a job situation which the scientist views as challenging, attractive, and rewarding. Considers such factors as the R and D establishment's organization and policies, salary administration, personnel development, utilization of the scientist's work, human relations, and introducing the new scientist and the new scientific employee to industrial research.

Lahiri, Dilip K. and Pijush K. Choudhuri.
Perceived importance of job factors by technical and nontechnical employees. Personnel psychology, vol. 19, no. 3, Autumn 1966, pp. 287-296.
"The present study attempts to ascertain whether the nature of the job as an independent variable has any effect on the perceptions of importance of different job factors and what, if any, are the significant differences between the rankings of technical and non-technical employees."

Industrial Organizations (Cont'd)

Laumann, Edward O. and Robert N. Rapoport.
The institutional effect on career achievement of technologists. Human relations, vol. 21, no. 3, August 1968, pp. 227-239.

Reports on investigation which surveyed a sample of 428 engineers and scientists who graduated in 1954 from three technological universities in northeastern United States. The object was to determine the relative contributions of a set of independent variables in predicting earned income, professional orientation, and self-assessed professional achievement.

McKelvey, William W.
Expectational noncomplementarity and style of interaction between professional and organization. Administrative science quarterly, vol. 14, no. 1, March 1969, pp. 21-32.

"The question prompting this study was what happens when professionals find that the organization employing them is not fulfilling their research and career expectations. The study was based on 121 professionals from two divisions of a research organization. The results were twofold. First, the perception of expectational unfulfillment ... was highly correlated with cynicism ... Second, cynical active professionals (called insurgents) received the lowest promotion eligibility rankings from their supervisors. In contrast, idealistic passive professionals (called ritualists) tended to receive the highest promotion eligibility rankings. Some implications of these results are discussed."

Manasse, Fred C.
Increase engineering productivity. American engineer, vol. 37, no. 12, December 1967, pp. 26-30.

Reviews factors which motivate engineers. Presents a three stage program for increasing the productivity of the engineering department.

Miller, George A.
Professionals in bureaucracy: role orientation and alienation among industrial scientists and engineers. Ann Arbor, Mich., University Microfilms, Inc., 1966. 250 pp.

Doctoral dissertation, University of Washington, 1966. Abstracted in Dissertation Abstracts, vol. 27, no. 6, December 1966, p. 1941A-1942A.

Miner, John B.
The prediction of managerial and research success. Personnel administration, vol. 28, no. 5, September-October 1965, pp. 12-16.

Report on a 7-year research program which has been probing "the significance of motivational factors for success in managerial vs. scientific jobs," and utilizing the Miner Sentence Completion Scale. The role motivation theory seems sustained by the findings. Implications are discussed concerning the selection of scientists and the working climate that is optimum for them.

Industrial Organizations (Cont'd)

Natiello, Thomas A.
Motivation for work preference. MSU business topics (Michigan State University), vol. 16, no. 2, Spring 1968, pp. 57-64.
"This article is a report of research that investigated some of the problems which an organization faces in utilizing and organizing its technical personnel through the use of a dual hierarchy--the function of the dual hierarchy being to allow upward mobility either through the managerial or line ranks, or through the engineering or staff ranks."

Natiello, Thomas A.
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New York University. Graduate School of Business Administration.
Scientists, engineers and managers; partners in space, by Alex W. Rathe and Dhun Irani. New York, 1968. 207 pp.
"The report discusses first the engineer and his work. ... It then takes up the impact of engineering management upon such work ... after a recap of the most pertinent findings of behavioral science research in one key area of executive concern, that of motivation...."
Partial contents: Creativity; The nature of motivation; Job enlargement; General and engineering management; Organizational planning; The supervisor as a planner; The practice of supervision /including guidance, stimulation, personal and professional development/; Excellence in executive leadership; Personnel evaluation, performance appraisals and management audits; Selection and placement; and Training.

O'Donnell, Cyril, ed.
The strategy of corporate research; a symposium. A research seminar conducted by the Graduate School of Business Administration, University of California, Los Angeles. San Francisco, Chandler Pub. Co., 1967. 205 pp.
Partial contents: Economizing scientific personnel; The scientist's influence on research programs; Evaluating the scientist and his program; The practical orientation of scientists. Other chapters are devoted specifically to the corporate aspects of research and development.
Sponsored by the McKinsey Foundation for Management Research, Inc.

Pelz, Donald C. and Frank M. Andrews.
Scientists in organizations; productive climates for research and development. New York, John Wiley and Sons, Inc., 1966. 318 pp.
Reports research conducted to measure the relationship between a scientist's performance and the organization of his laboratory. The study sought to determine what constitutes a stimulating environment for research personnel, to relate scientists' characteristics to performance, and to establish what laboratory environment is best suited to scientists at different ages and to those working singly and as teams.

Industrial Organizations (Cont'd)

Pewitt, James D.
Career progression dilemma facing scientists. Ann Arbor, Mich., University Microfilms, Inc., 1968. 233 pp.
Doctoral dissertation, University of Southern California, 1968.
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Reiss, Howard and Jack Balderston.
Motivating scientists. International science and technology, no. 54, June 1966, pp. 93-94, 96+.
Suggestions on ways to motivate the phenomena-oriented scientists working in an industrial laboratory with examples from the way it is done at North American Aviation. Topics emphasized are re-acculturation, staff selection, and the role of supervision.

Ritti, Richard R.
Control of "halo" in factor analysis of a supervisory behavior inventory. Personnel psychology, vol. 17, no. 3, Autumn 1964, pp. 305-318.
Discusses a study, part of a larger research project on engineering organization, of the effects of supervisory behavior on engineers' job satisfaction and productivity. Emphasis was on frequency description rather than on evaluation in an effort to avoid rating bias or halo.

Ritti, Richard R.
Work goals of scientists and enginers. Industrial relations, vol. 7, no. 2, February 1968, pp. 118-131.
Research comparing work goals of scientists and engineers in industrial R & D laboratories. Among the conclusions: (1)"Engineers employed in industry have considerably different work goals from those of research scientists similarly employed." (2) "Engineers seem to possess these goals when they first enter their employing organizations, that is, the observed differences do not seem to derive primarily from organizational experiences."

Rogers, Alfred S.
The modern look in motivation. Personnel journal, vol. 45, no. 5, May 1966, pp. 290-293.
Presents guidelines to motivation for the supervisor of scientists, engineers, and other technical personnel.

Industrial Organizations (Cont'd)

Stanley, Alexander O. and K. K. White.
Organizing the R & D function. New York, American Management Association, Inc., 1965. 223 pp. (AMA research study 72)
An overview of R & D organization, case study in 42 companies, and job descriptions for key managerial and supervisory positions relating to research and development.

Sterner, Frank M.
Managing and motivating engineers. Professional engineer, vol. 39, no. 7, July 1969, pp. 37-41.
Considers specific factors which contribute to motivating engineers as well as obstacles to doing so. Presents six points basic to motivating people and lists most potentially effective components of a management approach.

Swatez, Gerald M.
Social organization of a university laboratory. Ann Arbor, University Microfilms, 1967. 189 pp.
Doctoral dissertation, University of California (Berkeley), 1966. Abstracted in Dissertation Abstracts, vol. 27, no. 8, February 1967, pp. 2635-A--2636-A.

Tagiuri, Renato.
Value orientations and the relationship of managers and scientists. Administrative science quarterly, vol. 10, no. 1, June 1965, pp. 39-51.
"In this comparative study of the values held by scientists in industry, by executives, and by managers of research personnel, the values of these three groups were not found to be as different as the members of the groups seem to think. The value orientation each group attributes to the other groups is veridical, yet exaggerated in the relative strength of the values. The dynamics and possible implications of these observations for the interaction of these three groups in industry are examined."

Torrence, George W.
The motivation and measurement of performance. Washington, Bureau of National Affairs, Inc., 1967. 97 pp.
Chapter 8 takes up industry plans to attract and motivate scientific and technical employees. Three types are covered: inclusion in management plan, special awards for outstanding achievements, and special awards for patents.

Vollmer, Howard M.
Professional adaptation to organizations. In Vollmer, Howard M. and Donald L. Mills, eds. Professionalization. Englewood Cliffs, N. J., Prentice-Hall, Inc., 1966, pp. 276-282.
Research on ways in which scientists seek to preserve their professional autonomy and capabilities within the framework of large bureaucratic organizations, using such devices as "research entrepreneurship."

Industrial Organizations (Cont'd)

Wisconsin. University. Center for Advanced Study in Organization Science. Organizational factors in scientific performance in an industrial research laboratory. Madison, 1966. 172 pp. (Final technical report (ONR Contract Nonr-4743(00)).

The study investigates "sociometric, work group, and organizational structural variables which may significantly affect scientific performance in organizations." Results indicate that the relative importance of conditions of wisdom and novelty were "critically contingent upon the particular performance criterion considered, the prevailing level of coordination, and the restructuring requirements of the task."